Pre-Deconstruction Hydro-Mechanical Surface Behaviour: An Evidential Record of the Preston New Road Well Pad

Observational and LiDAR Analysis (2017–2026)

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Executive Summary

This report documents observed surface and near-surface behaviour at the Preston New Road well pad from construction through decommissioning, supported by aerial imagery and LiDAR elevation differencing (2018–2022).

The compiled record demonstrates:

• Recurrent surface wetting and fluid accumulation at fixed perimeter locations,
• Repeated intervention at the same geometric coordinates over multiple years,
• Persistent moisture expression at the well cellar interface,
• Boundary-aligned hydraulic behaviour under rainfall loading,
• Spatially organised negative elevation change in the surrounding landscape coincident with documented surface expression zones.

These behaviours are spatially coherent, temporally persistent, and concentrated along engineered interfaces rather than randomly distributed across the site.

This report does not assert subsurface mechanism, membrane breach, casing failure, or structural compromise. It does not attribute causation. Its purpose is to place structured evidence on record prior to irreversible modification of the engineered system.

The planned deconstruction of the pad will alter surface loading, drainage geometry, and subgrade stress distribution. Where hydro-mechanical activity has been repeatedly documented, disturbance before verification of current conditions may:

• Obscure diagnostic surface features,
• Modify hydraulic gradients and stress regimes surrounding the well cellar and casing system,
• Redistribute fines and aggregate masking pre-existing conditions,
• Remove material potentially exposed to operational fluids without formal classification and testing.

Once removed, the engineered configuration and its present equilibrium cannot be reconstructed for retrospective assessment.

Accordingly, proportionate pre-disturbance characterisation is requested before significant surface works commence. This request is grounded in documented spatial and temporal coherence of observed behaviour and is made to preserve evidential integrity and informed planning oversight.

The intent is not to assert failure, but to ensure that current conditions are verified before they are permanently altered.

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1. Purpose and Scope of This Report

This report compiles and documents observational and geospatial evidence relating to surface and near-surface behaviour at the Preston New Road well pad over its operational lifecycle and into the current decommissioning phase.

The document has been prepared in advance of planned deconstruction activities in order to place on record:

• Persistent surface water expression at defined perimeter and cellar interfaces,
• Recurrent boundary-aligned behaviour under rainfall loading,
• Localised aggregate redistribution and tonal variation at engineered interfaces,
• Magnitude-defined elevation change identified through independent LiDAR differencing (2018–2022).

The purpose of this report is not to determine subsurface mechanism or assign causation. Rather, it is to establish whether spatially organised and temporally persistent surface behaviour has been sufficiently characterised prior to irreversible disturbance of the engineered system.

Where hydro-mechanical expression is documented in low-gradient, shallow groundwater environments, alteration of loading and drainage configuration may modify existing conditions. The central question addressed is therefore procedural:

Has the present state of the site been adequately characterised before deconstruction proceeds?

This report is submitted in good faith to assist planning oversight and to ensure that decision-making occurs with full awareness of documented surface behaviour and associated uncertainties.

2. Site Context and Baseline Conditions

2.1 Geographic and Hydrogeological Context

The Preston New Road well pad is located within low-lying agricultural land on the Fylde coastal plain, to the east of Blackpool and west of Preston, Lancashire. The surrounding landscape is characterised by open fields, drainage ditches, and limited topographic relief. Elevation variation across the immediate area is modest, with gentle gradients that influence surface water routing and shallow groundwater behaviour.

2.1.1 Geographic Setting

The pad footprint occupies previously cultivated farmland within a wider matrix of agricultural fields and rural infrastructure. The broader setting is not one of steep terrain or confined valley drainage, but of open, laterally connected land surfaces where small elevation differences can influence localised ponding and flow concentration.

Figure 1 - Location of the Preston New Road well pad within the Fylde coastal plain, Lancashire. The site lies within low relief agricultural land between Blackpool and Preston.

Figure 2 - DJI_0016 - 24/8/17 - Oblique aerial view of the Preston New Road well pad, 24 August 2017. The engineered platform is shown within surrounding agricultural land. The north-eastern and south-eastern margins are visible adjacent to pasture and field boundaries.

2.1.2 Surface Water and Floodplain Context

The site lies within a low-gradient catchment where surface water pathways and seasonal ponding are characteristic features of the wider landscape. Historical mapping by Lancashire County Council identifies surface water flow routes and areas susceptible to ponding in proximity to the pad location.

The landform does not exhibit pronounced natural channels at the pad footprint. Instead, shallow overland flow and diffuse surface water routing are typical. In such settings, minor changes in ground level, compaction, or engineered boundaries can influence local hydraulic behaviour.

Detailed mapping of recorded surface water pathways is presented in Section 2.2.

2.1.3 Shallow Hydrogeological Sensitivity

The Fylde plain is underlain by superficial deposits that commonly include glacial and estuarine sediments. In low-relief coastal plains of this type, shallow groundwater levels can respond seasonally to rainfall, drainage modification, and surface loading.

Where engineered structures are introduced, including impermeable surfaces and perimeter drainage systems, the natural recharge and discharge balance may be altered. In flat terrain, small variations in subgrade condition or boundary configuration can lead to localised concentration of shallow flow.

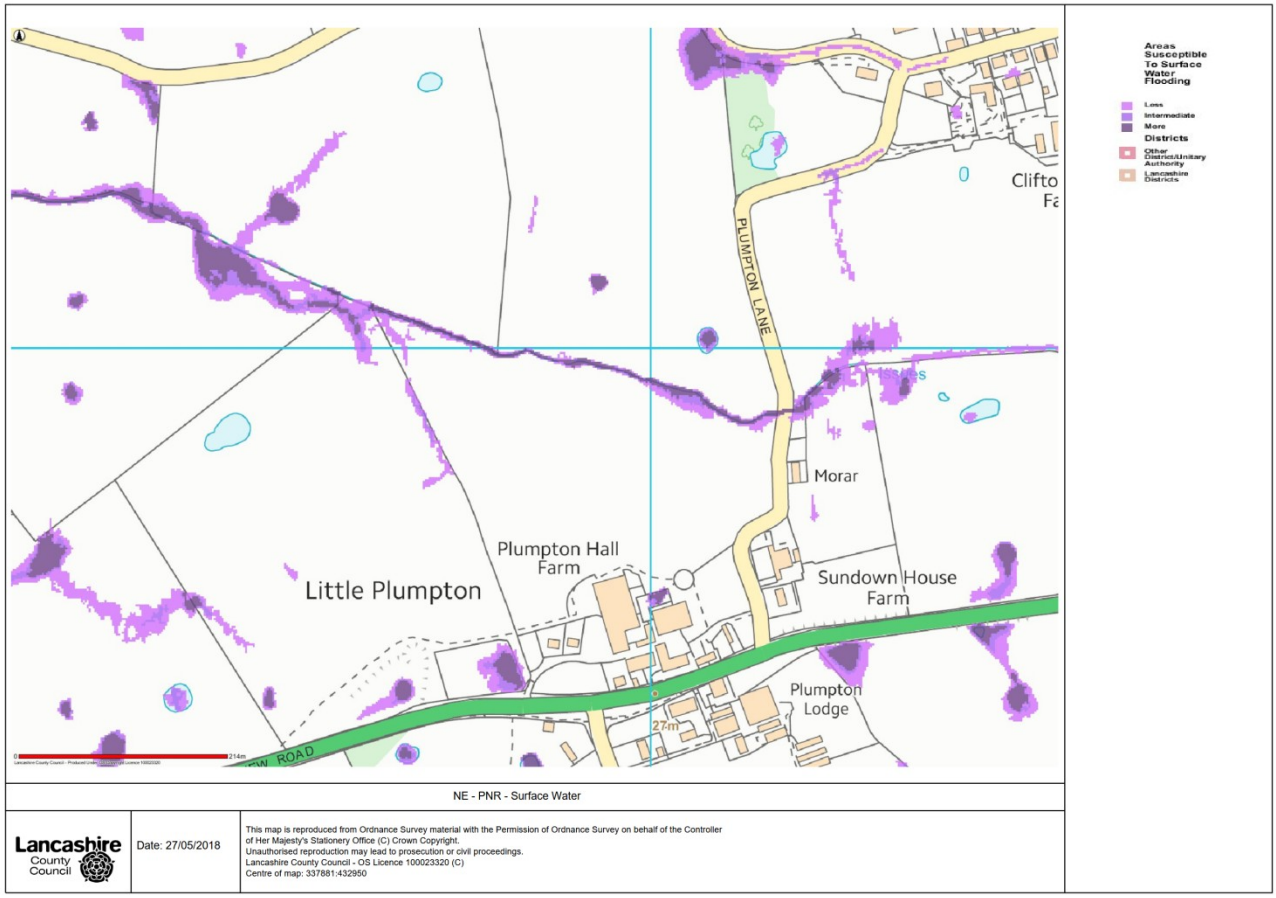
The purpose of this section is to establish that the site is situated within a setting where shallow hydraulic processes are active and sensitive to modification. Subsequent sections document how these characteristics were expressed during and after pad construction.

Figure 3 - Local view of the Preston New Road well pad and surrounding agricultural land. Multiple field ponds and drainage features are visible within the immediate vicinity. Each corner is labelled with the cardinal direction it faces and margins are therefore SE, SW, NE & NW. Google Earth 08/2025

2.2 Pre-Construction Surface Conditions

The Preston New Road site is located within a low relief agricultural plain characterised by shallow gradients, field drains, artificial ditches and isolated surface water bodies. The surrounding land is extensively managed for agriculture and exhibits numerous small ponds and drainage features consistent with a high water table environment.

Lancashire County Council flood mapping indicates that the site lies within a mapped flood risk area associated with surface water accumulation. The mapped flood extents predate construction of the well pad. The pre development flood mapping is spatially consistent with observed historical ponding locations within the footprint of the pad, particularly along the north western and eastern margins.


Areas Susceptible To Surface Water Flooding
Less
Intermediate
More
Districts
Other District/Unitary Authority
Lancashire Districts
PLUMPTON LANE
Morar
Plumpton Hall Farm
Little Plumpton
Sundown House Farm
Plumpton Lodge
27m
NE - PNR - Surface Water
Lancashire County Council
Date: 27/05/2018
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Centre of map: 337881:432950

Figure 4 - Regional surface water context showing mapped flood risk zones and proximity to local drainage features.

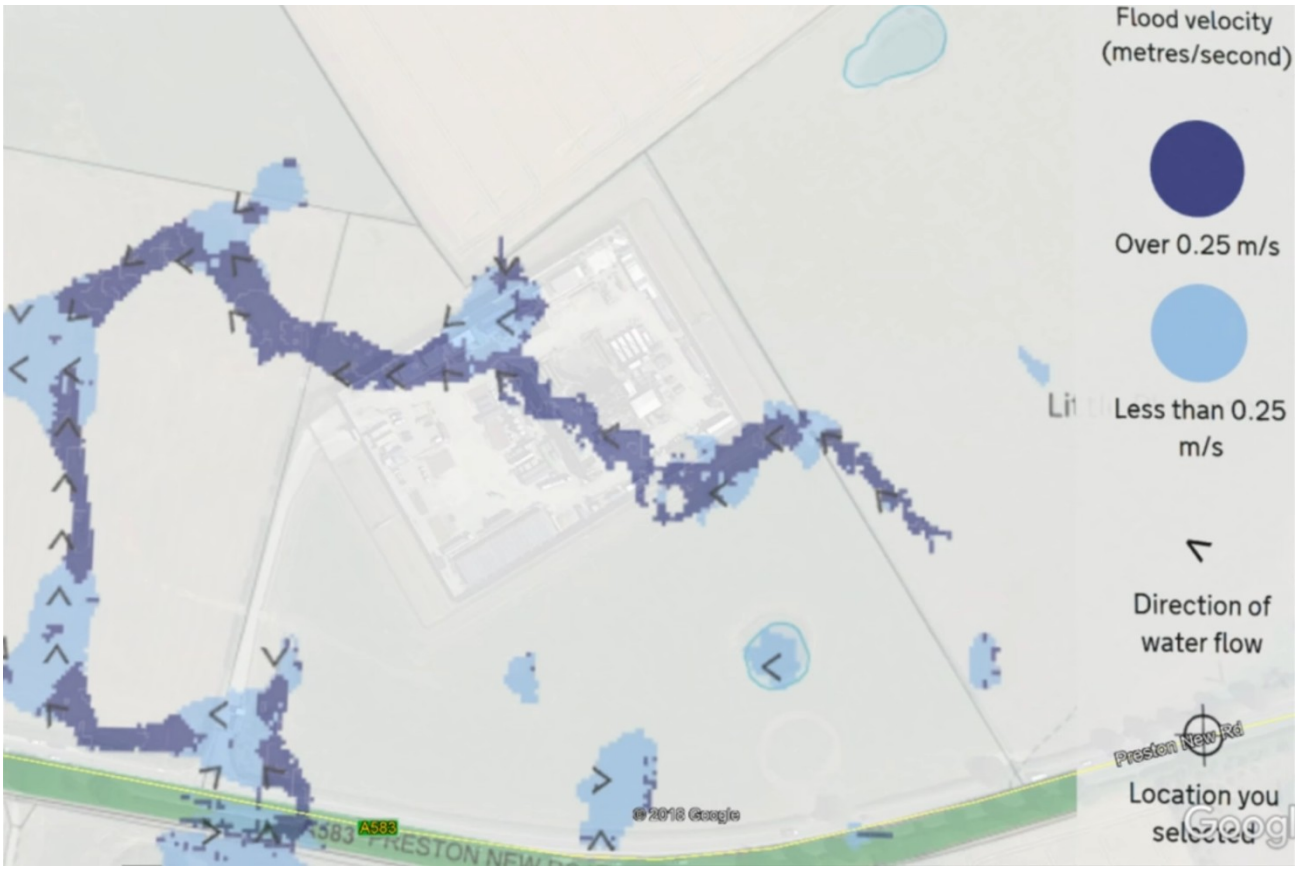

Figure 5 - Pre development flood mapping overlaid on site footprint demonstrating spatial correspondence with early observed ponding zones.

The broader area is drained by a network of minor watercourses and field drains that ultimately connect to larger regional drainage systems. In low gradient landscapes of this type, surface water movement is often slow and controlled by subtle topographic variations, artificial drains and soil permeability contrasts. Small changes in ground level or boundary condition can materially alter local drainage pathways.

The site is therefore situated within a hydrologically sensitive setting where shallow groundwater, surface water accumulation and engineered drainage systems are closely coupled. In such environments, installation of a large impermeable surface introduces a new hydraulic boundary condition. Depending on subsurface gradients and drainage connectivity, this may alter, concentrate or redirect shallow groundwater and surface water pathways.

The Environmental Statement submitted for the development includes a conceptual cross section of the well pad and underlying strata. This cross section presents the site as underlain by Upper Boulder Clay over superficial deposits including clay and Middle Sands identified as a Secondary A aquifer, underlain in turn by lower clay and Mercia Mudstone.

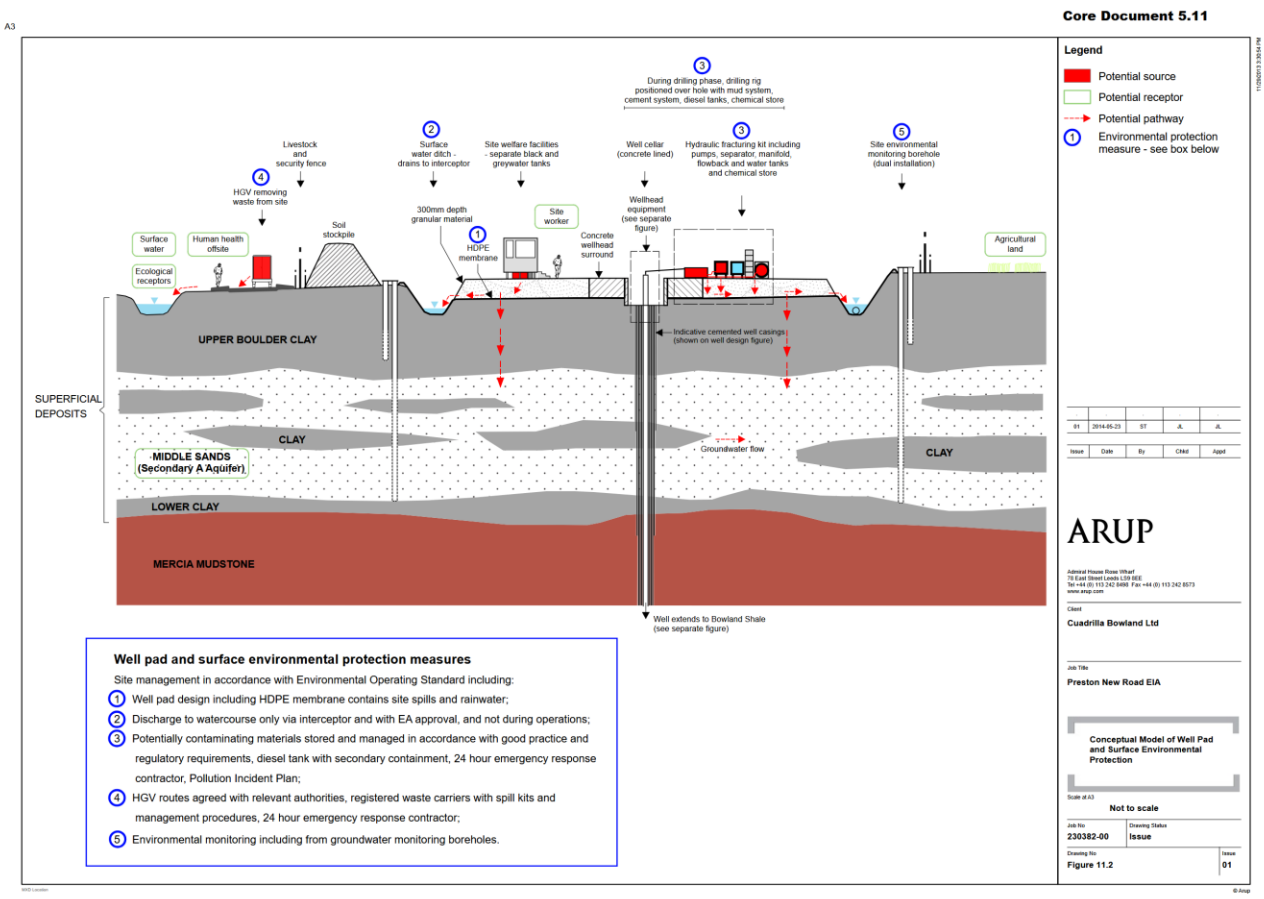
Core Document 5.11
A3
Legend
Potential source
Potential receptor
Potential pathway
Environmental protection measure - see box below
During drilling phase, drilling rig positioned over hole with mud system, cement system, diesel tanks, chemical store
Livestock and security fence
Surface water ditch - drains to interceptor
Site welfare facilities - separate black and greywater tanks
Well cellar (concrete lined)
Hydraulic fracturing kit including pumps, separator, manifold, flowback and water tanks and chemical store
Site environmental monitoring borehole (dual installation)
HGV removing waste from site
300mm depth granular material
Site worker
Wellhead equipment (see separate figure)
Soil stockpile
HDPE membrane
Concrete wellhead surround
Surface water
Human health offsite
Ecological receptors
Agricultural land
UPPER BOULDER CLAY
Indicative cemented well casings (shown on well design figure)
SUPERFICIAL DEPOSITS
CLAY
MIDDLE SANDS (Secondary A Aquifer)
Groundwater flow
CLAY
LOWER CLAY
MERCIA MUDSTONE
Well extends to Bowland Shale (see separate figure)
Well pad and surface environmental protection measures
Site management in accordance with Environmental Operating Standard including:
1 Well pad design including HDPE membrane contains site spills and rainwater;
2 Discharge to watercourse only via interceptor and with EA approval, and not during operations;
3 Potentially contaminating materials stored and managed in accordance with good practice and regulatory requirements, diesel tank with secondary containment, 24 hour emergency response contractor, Pollution Incident Plan;
4 HGV routes agreed with relevant authorities, registered waste carriers with spill kits and management procedures, 24 hour emergency response contractor;
5 Environmental monitoring including from groundwater monitoring boreholes.
ARUP
Client
Cuadrilla Bowland Ltd
Job Title
Preston New Road EIA
Conceptual Model of Well Pad and Surface Environmental Protection
Not to scale
Job No
230382-00
Drawing Status
Issue
Drawing No
Figure 11.2
Issue
01

Figure 6 - Cross section of the well pad design and underlying stratigraphy as presented in the Environmental Statement.

The conceptual model indicates that the clay units provide vertical separation between surface activities and the underlying Middle Sands aquifer. Groundwater flow is illustrated as laterally distributed within the sand unit. Surface protection measures are described as comprising an engineered pad constructed above natural ground level, incorporating a High Density Polyethylene membrane intended to contain site runoff and spills. Surface water generated on the pad is described as being directed to an interceptor system prior to controlled discharge. The design also references dual installation groundwater monitoring boreholes.

The Environmental Statement therefore presents a protection model based on three primary elements: containment of surface fluids at pad level, vertical separation by low permeability clay strata, and lateral groundwater movement within defined permeable horizons.

Construction of the pad involved excavation and regrading of the original ground surface, installation of engineered fill, and placement of impermeable membrane layers prior to operational activities. The -pre-construction imagery demonstrates that prior to full installation of the membrane system, portions of the site footprint exhibited areas of standing water and locally saturated ground, particularly along the north western and both eastern margins.

These early conditions are relevant to the assessment of baseline ground behaviour. In low gradient clay dominated landscapes, shallow water tables may occur seasonally or persistently near ground surface. Where permeable lenses or drainage features are present within otherwise cohesive strata, groundwater may emerge locally as ponding or seepage, particularly following rainfall events or where surface gradients are interrupted.

The introduction of a large impermeable surface, elevated above surrounding agricultural land and bounded by engineered margins, constitutes a significant hydraulic boundary change. Such a boundary may modify infiltration patterns, restrict vertical recharge beneath the pad, and concentrate lateral groundwater movement toward pad margins. It may also alter surface runoff pathways where subtle pre existing gradients are overridden by engineered slopes.

The conceptual cross section in the Environmental Statement assumes that vertical separation is maintained by intact clay units and that surface containment is achieved by the installed membrane system. The pre-construction surface conditions and early imagery indicate that shallow water accumulation was already present within the site footprint prior to drilling operations. This establishes that the site was not hydrogeologically inert at baseline and that shallow water processes were active prior to operational loading.

The interaction between pre existing shallow water conditions and the subsequently installed engineered pad is therefore central to understanding later observed ground behaviour. The degree to which the engineered system conformed to, redirected or interrupted pre existing shallow groundwater and surface drainage pathways is not directly addressed in the conceptual cross section, but is material to subsequent observations discussed in later sections of this report.

2.3 Construction Phase Water Sensitivity (Feb–May 2017)

Early site preparation works undertaken in February 2017 occurred in visibly wet ground conditions. Aerial imagery from 15 February 2017 shows standing water within the footprint of the proposed pad prior to full formation and levelling. Ponding is evident along the north western margin and in low areas corresponding with mapped surface water risk. These observations indicate that shallow groundwater or surface water accumulation was present at the outset of construction activities.

Figure 7 - 15/02/17 - Early image showing pre formation ponding within the pad footprint.

Subsequent imagery from late February 2017 shows continued ponding across the partially formed pad surface. Despite grading works, water remained present in shallow depressions, suggesting limited natural drainage and minimal surface gradient. The persistence of standing water over multiple days indicates that water was not solely the result of short duration rainfall but was influenced by local ground conditions and low permeability soils.

Figure 8 - 25/02/17 - early image showing persistent ponding following initial levelling.

Images from 10 March 2017 show attempts to dry and stabilise wet ground using lime treatment. Lime appears to have been applied across visibly saturated areas in order to improve workability. However, ponding remains visible adjacent to treated zones, and heavy machinery is shown operating on visibly soft and waterlogged subgrade. The presence of rutting and surface disturbance indicates reduced bearing capacity at that stage of construction.

Figure 9 - 10/03/17 Early image showing lime stabilisation efforts in wet ground conditions.

Video evidence from early April 2017 shows that the pad had been levelled and largely dried, and that an underground tank had been installed in the north western sector of the pad. This location corresponds spatially with earlier areas of persistent ponding. It is not clear from available documentation whether installation of the tank formed part of the original drainage design or was introduced in response to site conditions encountered during construction. The timing and location are material in understanding subsequent surface water behaviour.

Figure 10 - 17/4/17 - Early image showing installation of subsurface tank in former ponding area.

By mid May 2017, installation of the HDPE membrane system was underway. Imagery from 16 May 2017 shows areas of residual dampness and localised unevenness within the eastern quadrant of the pad during membrane placement. Ponding visible in earlier images appears to correspond with areas where the formation surface remained darker and less uniform. In low gradient settings, even minor undulations can concentrate water beneath impermeable layers.

Figure 11 - DJI_0006 - 16/5/17 - Early image showing membrane placement over damp subgrade.

Images taken on 22 and 23 May 2017 show sections of white geotextile and geomembrane being laid across areas that appear saturated and uneven. In some locations, seams are temporarily weighted with gravel while underlying ground conditions appear visibly wet. Subsequent images show wrinkling of the membrane layer, which can occur where subgrade preparation, tensioning or moisture conditions are suboptimal. While the detailed construction quality assurance documentation is not reviewed here, the visible sequence demonstrates that membrane installation occurred in the context of recent saturation and variable ground conditions.

Figure 12 - Side by side comparison of images from 23/05/17 taken at 06:48 (left DJI_0023) and 18:43 (right DJI_0040)

Taken together, the construction phase imagery indicates that the site exhibited persistent water sensitivity prior to and during installation of the engineered containment system. Early ponding, stabilisation efforts, targeted tank installation and membrane placement over areas of recent saturation establish that water management was an active constraint during formation of the pad.

2.4 CQA Plan Requirements (Summary)

The Construction Quality Assurance plan for the geomembrane system sets out the design intent, installation standards and verification procedures required to ensure that the well pad functions as an effective environmental containment barrier. The primary objective of the system is to prevent uncontrolled discharge of contaminants to underlying soils and groundwater and to control surface water within the engineered footprint.

The design comprises a prepared formation layer, a geotextile protection layer, a high density polyethylene geomembrane and associated drainage and interceptor systems. The geomembrane is intended to act as the principal impermeable barrier, with seams welded and tested to achieve hydraulic integrity across the entire pad footprint. The system is supported by perimeter drainage ditches and controlled discharge via interceptor mechanisms, subject to regulatory approval.

The CQA documentation specifies that the subgrade must be properly prepared prior to membrane placement. This includes grading to the required profile, removal of protrusions or sharp objects, and achievement of a smooth and firm surface capable of supporting the geomembrane without deformation. The subgrade is required to be free of standing water, excessive moisture and soft or yielding zones at the time of installation. Any unsuitable areas are to be remediated prior to liner placement.

Membrane installation requirements include controlled deployment under suitable weather conditions, avoidance of excessive wrinkles, proper anchoring at perimeter trenches and systematic welding of seams. Seam integrity is to be verified through non destructive and destructive testing in accordance with recognised standards. Repairs are to be documented and retested.

The plan also requires continuous inspection by suitably qualified personnel, with installation records maintained for panel placement, seam testing, weather conditions and any corrective actions undertaken. The purpose of these measures is to ensure that the installed system reflects the approved design and performs as a continuous containment barrier.

Environmental protection measures described in the broader environmental statement include the use of perimeter ditches to intercept surface water, discharge only via approved routes, storage of potentially contaminating materials within secondary containment, and groundwater monitoring through boreholes installed around the site.

In summary, the CQA plan establishes clear requirements for subgrade condition, membrane integrity, drainage control and inspection oversight. Compliance with these requirements is fundamental to the long term performance of the containment system in a setting characterised by shallow groundwater and surface water sensitivity.

2.5 Apparent Departures from Installation Controls

The construction phase imagery described in Section 2.3 can be considered in light of the installation controls summarised in Section 2.4. The CQA plan requires that the subgrade be smooth, firm and free of standing water at the time of membrane placement. It also requires that soft or yielding areas be remediated prior to liner installation.

The photographic record indicates that, during February and March 2017, persistent ponding was present within the pad footprint and that lime stabilisation was applied in response to visibly saturated conditions. While these measures appear to have improved workability, the images demonstrate that water sensitivity was an active issue during formation of the pad.

By mid May 2017, during membrane placement, areas of residual dampness and localised unevenness are visible within the eastern quadrant. Seams are shown being laid across areas that had recently exhibited ponding. In several images, gravel weighting is present while underlying ground appears wet. The membrane surface also displays visible wrinkling prior to final aggregate cover.

The CQA requirements emphasise subgrade uniformity and the avoidance of excessive wrinkles during deployment. Wrinkles can occur for a range of reasons including temperature variation and handling; however, where installation occurs over locally uneven or moisture affected subgrade, differential settlement may increase strain concentrations at seam locations.

The record does not allow a definitive conclusion regarding compliance or non-compliance with the CQA procedures. However, the visual sequence indicates that liner placement occurred in the context of recently saturated and locally variable ground conditions. In low gradient clay dominated settings, such conditions may influence long term settlement behaviour and hydraulic interface performance.

These observations do not in themselves demonstrate membrane failure. They do, however, establish that the containment system was installed under conditions where shallow water presence and subgrade variability were evident. In a hydrogeologically sensitive setting, this introduces a degree of

uncertainty regarding long term deformation tolerance and perimeter hydraulic interaction that warrants consideration in advance of any disturbance of the engineered system.

Figure 13 - DJI_0028 15/1/2018 External surface water conditions surrounding the well pad during operational phase, showing widespread ponding within adjacent agricultural fields and drainage features.

3. Observational Record – Fixed Zones

This document records observed ground and surface water behaviour at the Preston New Road well pad over the duration of its operational lifecycle. The purpose of the report is to present a structured and location-based record of recurring conditions documented through aerial imagery and publicly available datasets.

The timing of deconstruction introduces the potential for disturbance of the engineered system and underlying ground conditions. Establishing an accurate and comprehensive record of observed behaviour prior to removal is therefore considered material to planning oversight and informed decision making.

Figure 14 - 21/8/17 - SE margin showing fixed observational zones

3.1 Zone A – SE Perimeter (Ingress Location 1)

This location corresponds to a section of the south eastern perimeter where repeated ponding and surface change were documented during early site operations.

Imagery from 9 April 2017 shows standing water pooled along the external fence line at this location. The fence base does not appear flush with the adjacent ground surface, and a shallow depression is visible immediately outside the perimeter.

Figure 15 - DJI_0004 - 9 April 2017 showing early external ponding along SE perimeter.

By 22 June 2017, the same location shows evidence of surface reworking along the fence line. The fence alignment appears visually altered relative to earlier imagery, and the ground immediately inside and outside the perimeter exhibits disturbance consistent with localised intervention. Surface water is not visible in this frame, however the topographic low remains apparent.

Figure 16 - DJI_0075 - 22 June 2017 showing surface works and fence alignment change at same location.

On 22 August 2017, dark fluid accumulation is visible along the external margin at the same location. The fluid exhibits surface sheen under sunlight. Corresponding darkened areas are visible on the internal membrane surface adjacent to the fence line.

Figure 17 - DJI_0215 - 22 August 2017 showing dark fluid accumulation at fence interface and corresponding internal surface staining.

Across these dates, the sequence documents a progression from initial external ponding, to surface modification, to the presence of accumulated fluid at the fence interface. The geometry of the fence base relative to the surrounding ground surface presents a potential preferential pathway at this location.

Sequential imagery from October 2017 and January 2018 demonstrates recurring surface water accumulation along the perimeter boundary. Despite apparent surface regrading and soil placement between these dates, preferential drainage patterns remain evident. The perimeter fence line does not appear flush with the external ground surface, and visible membrane deterioration occurs over this period. The images demonstrate persistent hydraulic expression at this location.

Imagery dated 2 October 2019 shows the introduction of additional gravel material along the internal margin adjacent to the previously documented ponding location. The gravel appears directed toward an external gravel strip beyond the fence line. This configuration is consistent with an attempt to manage or redistribute surface water at this perimeter segment. The location corresponds spatially with the earlier accumulation area documented in April–August 2017.

Figure 18 - DJI_0059 - 2 October 2019 showing gravel placement and directed drainage configuration at SE perimeter (Zone A).

By 19 March 2025, additional linear barrier elements are visible along the external margin of the same segment. These appear installed parallel to the fence line and may function to influence surface flow behaviour or limit lateral movement across the verge corridor. The repeated modification of surface geometry at this fixed location indicates that this perimeter segment remained operationally active in terms of water management across multiple years.

Figure 19 - DJI_0301 - 19/03/25 - showing linear barrier installation along SE perimeter at previously documented ponding location.

Imagery from 8 February 2026 shows parallel linear features extending longitudinally between the inner and outer fence lines at this same location. These lines are visible within the grassed verge and correspond spatially with the previously documented hydraulic expression zone. The geometry is consistent with persistent preferential flow alignment or repeated surface trafficking along a fixed corridor.

Figure 20 - DJI_0360 - 08/02/26 showing parallel linear surface features between fence lines at Zone A.

Across the full observational sequence (April 2017 – February 2026), this location demonstrates:

•Initial external ponding and shallow depression,

•Subsequent surface reworking,

•Fluid accumulation with surface sheen,

•Recurring water accumulation and membrane deterioration,

•Installation of gravel drainage measures,

•Later addition of linear barrier elements,

•Continued expression of parallel surface features within the verge corridor.

The recurrence of surface modification and water-related expression at a fixed geometric location indicates that this perimeter segment functioned as a persistent hydraulic sensitivity point throughout the operational lifecycle.

The observations presented here are confined to surface behaviour. No inference is made regarding subsurface structure, depth, or mechanism. The documented sequence establishes spatial persistence and temporal evolution at a defined perimeter segment.

The oblique view in Figure X provides spatial context for the SE perimeter relative to the broader pad geometry and adjacent field. While not required for evidential demonstration, the perspective

illustrates the fixed alignment of the observed zone in relation to pad layout and drainage orientation, supporting the continuity of location reference as the report transitions to Zone B.

Figure 21 - DJI_0515 - 21/01/26 Oblique view of SE margin looking NE, providing spatial context prior to transition to Zone B, also pictured towards the top of the image.

3.2 Zone B – East Corner (Ingress Location 2)

Zone B corresponds to the eastern corner of the well pad where the perimeter alignment changes direction from the north east to the south east boundary. This location exhibits a sequence of repeated surface modification, drainage intervention, and evolving boundary conditions over time.

Imagery from 23 August 2017 shows early disturbance at the eastern corner relative to adjacent perimeter sections. Localised external ground discolouration is visible immediately below the fence line. Internally, line routing and equipment placement are already established adjacent to the boundary.

Figure 22 - DJI_0070 - 23/8/17 - Early surface disturbance at SE margin close to the east corner with localised external ground discolouration.

By 29 August 2017, internal connector positioning and localised soil disturbance are clearly visible immediately inside the fence alignment at this corner. The external verge exhibits subtle tonal variation consistent with surface disturbance when compared to adjacent undisturbed grassland.

Figure 23 - DJI_0054 - 29/08/17 Internal connector routing and relative soil disturbance at fence interface, SE margin.

Imagery from 17 September 2017 shows multiple locations along the fence base where contact between the fence panels and the external ground surface appears non-uniform. Small gaps and irregular soil interface are visible at several points along the south eastern boundary, including the corner transition. These conditions differ from more flush sections elsewhere along the perimeter.

Figure 24 - DJI_0167 - 17/09/17 (Non-uniform fence–soil interface and visible gaps along eastern boundary.

Imagery dated 25 October 2017 demonstrates the presence of pooled brown fluid along the internal membrane margin at Zone B. At the same time, fluid of comparable colour and opacity is visible immediately external to the fence line at the corresponding location. The fence base appears to form the only separation between these fluid bodies. This frame represents the first contemporaneous documentation of fluid accumulation on both sides of the perimeter boundary within the same hydraulic event.

Figure 25 - DJI_0087 - 25/10/17 - water inside and outside the pad have similar appearances.

Imagery dated 27 October 2017 shows a defined flow path extending from the perimeter fence into the adjacent field. Disturbed soil and linear grass displacement indicate an engineered trench. Pale bagged materials are visible at the fence base at the point of egress, consistent with temporary flow control measures.

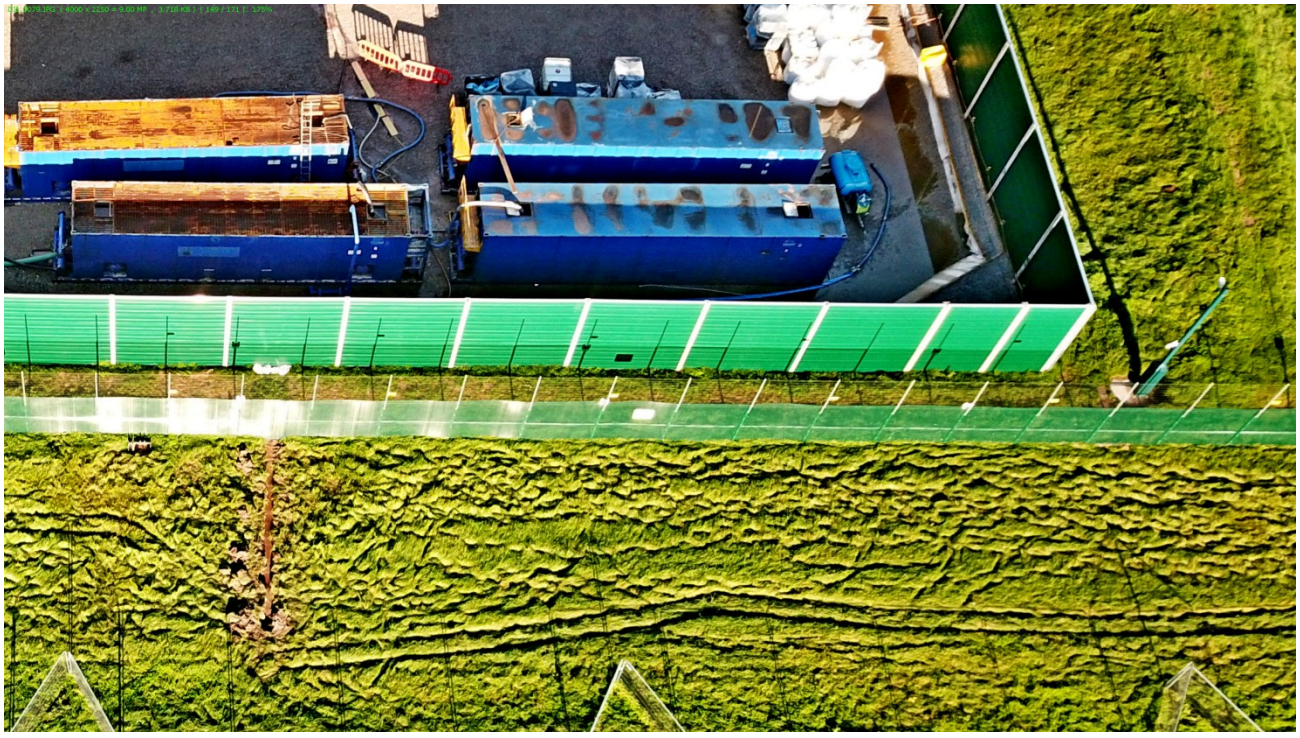

Figure 26 - DJI_0079 - 27/10/17 - Zone B: trench and temporary sandbag placement at fence interface following hydraulic event. A localised darkened membrane area is visible at the east corner in a zone repeatedly associated with fluid accumulation.

Subsequent imagery shows installation of gravel drainage infrastructure at this location. The temporal proximity suggests that mitigation measures followed immediately after the documented hydraulic event.

By 15 January 2018 standing water is visible in proximity to the eastern boundary. A gravel trench is present directing flow toward the external margin. The geometry of this trench indicates deliberate surface regrading at the corner location.

Figure 27 - DJI_0037 - 15/01/18 - Water pooling and gravel trench directing surface flow toward external drainage at East corner.

A corresponding image from the same date (DJI_0040) shows external excavation works at the eastern corner. Internally, darkening of the membrane surface is visible adjacent to the fence alignment at the same location. The excavation footprint and internal surface condition appear spatially coincident across the boundary.

Figure 28 - DJI_0040 - 15/01/18 - External excavation visible at the south east margin close to the east corner. Internal membrane darkening persists and new staining appears. A discrete change in gravel grade and texture is visible along the internal perimeter, consistent with recent surface reworking.

By 1 June 2018, a barrier enclosure has been installed around the prior excavation area. A white square cover is visible at the centre of this enclosure. The configuration suggests the area had transitioned from open excavation to contained surface feature.

Figure 29 - DJI_0067 - 01/06/18 - Barrier installed around prior excavation at East corner with central access cover.

Imagery from 15 October 2019 shows the access cover open, with two green hoses extending into the chamber. Black plastic sheeting is visible wedged along the fence base to the left of the corner location. The continued presence of surface management measures indicates ongoing intervention at this boundary point more than two years after initial disturbance was documented.

Figure 30 - DJI_0133 - 15/10/19 - Access cover open with hoses in situ; black plastic visible along fence interface.

The most recent image from 8 February 2026 shows that the internal membrane surface at the eastern corner now appears uniformly darkened relative to earlier imagery. Parallel linear surface markings are visible inside the fence alignment running broadly parallel to the boundary. Externally, the verge exhibits repeated patterning distinct from adjacent pasture, consistent with persistent localised surface modification.

Figure 31 - DJI_0361 - 08/02/26 - East corner membrane darkening and parallel surface lines adjacent to fence alignment.

Across this sequence, Zone B documents a progression from early localised disturbance (August–September 2017), to trench installation and excavation (January 2018), to installation of a contained surface structure (June 2018), to continued access and hose placement (October 2019), and ultimately to a changed and stabilised surface condition by February 2026. The recurrence of intervention at the same corner location over multiple years establishes this point as a persistent boundary feature within the observational record.

Figure 32 - DJI_0079 - 01/06/2018 - SE perimeter, 1 June 2018. External gravel trench visible along the SE margin. Perpendicular gravel strips extend from the external perimeter fence at Zones A and B into the trench. The configuration is consistent with installation of a post construction perimeter drainage measure.

Similar perimeter trenching is visible along the north-western boundary in later imagery, suggesting that perimeter drainage measures were implemented along multiple margins following initial operational phases.

Zones A and B represent ingress-type boundary expressions located along the south eastern margin. The following sections transition to locations exhibiting outward flow alignment and egress-type surface expression along the north western boundary.

3.3 Zone C – NW Egress Margin

The NW margin occupies the lowest structural boundary of the pad and overlies the area that was previously ponded during early site preparation. Flood mapping identifies this area as a natural pooling location. Its position at the pad perimeter makes it a critical interface between engineered surface controls and the surrounding agricultural land.

Early footage indicates that tonal variation and surface wetness were present at this margin from the early operational period.

Figure 33 - DJI_0233 - 02/06/17 - A zoomed composite highlights three distinct zones along the NW boundary:

- *Yellow (left): Active subsurface works underway during early construction.*
- *Red (centre): Persistent wetness and visible surface disturbance present from early operations.*
- *Blue (right): Less pronounced but still visible seepage expression.*

Even at this early stage, the central zone exhibits darker soil tone and subtle erosional morphology compared to adjacent sections of the perimeter slope.

Figure 34 - DJI_0021 - 07/08/17 - Moisture is present along the fence boundary. The soil on the pad perimeter slope, where fluid meets the soil interface, is visibly darker than adjacent sections.

To the left of the camera pole, several lighter-toned patches appear within the engineered bank. These patches display irregular boundaries and subtle alignment consistent with shallow surface flow or movement pathways.

The NW margin at this stage shows localised wetness rather than uniform saturation.

Figure 35 - DJI_0178 - 22/08/17 - A patterned disturbance is visible at the fence line consistent with sediment transport or water-driven erosion. Two square access covers appear partially covered in sediment accumulation.

The morphology of the slope at the fence base appears uneven, with small channels or transport marks visible downslope.

Scaffolding has been added to the yellow zone since the initial phase.

Figure 36 - DJI_0284 - 22/08/17 - Scaffolding is clearly visible to the north of the NW margin. Sections of the fence line show gravel material overtopping or extending onto the perimeter slope at the base of the fence.

Following precipitation events, the margin exhibits surface wetness. However, the sediment patterning observed is directional rather than uniform, suggesting mobilisation rather than passive deposition alone.

Figure 37 - DJI_0016 - 31/08/2017 - The perimeter bank shows further development of erosion patterns. Within a shallow puddle, multiple red-toned streaks are visible. These streaks originate within the puddle body and extend downslope.

The linear and downhill orientation of these streaks indicates movement along a gradient rather than isolated sediment settling. The tonal variation is spatially organised rather than random. The slope surface shows minor incision features and tonal banding consistent with repeated wetting and transport episodes.

By mid-September, surface moisture is reduced compared to late August imagery. However, the grass along the fence line displays distinct patterning.

Figure 38 - DJI_0067 - 18/09/17 - Although the surface appears relatively dry at the time of capture, the residual patterning suggests prior saturation pathways that remain morphologically expressed.

The vegetation tone varies in narrow bands aligned downslope. These bands are darker than surrounding grass and form elongated, gravity-aligned features. This persistence independent of immediate rainfall intensity indicates that the NW margin retains structural memory of fluid movement.

Overnight on the 24/10/17 a sustained rainfall even caused the area to become saturated. The margin showed several colour tones consistent with fluid on the pad.

Figure 39 - DJI_0057 - 25/10/2017 - Heavy rain event. Multiple colour tones (red, cream, dark) visible. Demonstrates colour variation during fluvial loading.

Another fluvial event caused a repeat saturation of the surrounding landscape

Figure 40 - DJI_0020 - 23/11/17 - NW margin saturated along with the rest of the fields adjacent to the pad. A triangle of temporary fencing can be seen close to the pool of fluid.

In 2018 there is fluid still present, attempts at mitigation appear to have been made.

Figure 41 - DJI_0170 - 15/1/18 - Fluid appears redder towards the perimeter fence and darker towards the North. Adjacent field is still creamy in colour.

In later footage these mitigation attempts are expanded in this area and along the margin.

Figure 42 - DJI_0028 - 1/6/2018 - In the red and blue sections of the NW margin further gravel drains have been installed. A red line of what appears to be seepage is visible in the middle of the image on the slope between the inner and outer fences.

Future intense fluvial events subsequently overwhelm the mitigation attempts.

Figure 43 - DJI_0207 - 29/09/2019 - Fluvial event overwhelming intervention measures. External expression visible. The internal fluid is similar colour and turbidity.

In the following month the water pooling at the surface is seen to extend to the south along the margin and then heads west along existing drainage contours. This development of flow may indicate progressive surface connectivity under loading.

Figure 44 - DJI_0021 - 11/10/2019 - Fluid connected to western corridor (as referenced in LiDAR discussion). Important for spatial continuity.

Images showing the internal membrane along this margin show the development of dark patches and wrinkles that match with external erosion and seepage patterns

Figure 45 - DJI_0104 - 13/03/25 - Red lines point to the areas of the internal membrane where signs of structural irregularity are visible.

The chronological record demonstrates that the NW boundary is not a static perimeter condition but a recurrent zone of hydro-morphological response. Wetness localisation, sediment mobilisation, tonal variation, and subsequent drainage interventions are repeatedly observed. Under intense rainfall, this margin exhibits continuity with surrounding land, extending along existing drainage contours and previously identified subsidence corridors.

The progression observed along the NW margin provides contextual grounding for the documented operational flood events that follow. The events of October 2017, November 2017, and September 2019 are presented below as discrete hydrological episodes within an already morphologically responsive boundary zone.

4. Documented Operational Flood Events

This section documents major rainfall-driven flooding episodes that occurred during the operational life of the pad. These events provide high-load hydrological conditions under which perimeter behaviour, surface controls, and boundary responses can be observed under stress.

Unlike routine wetting or localised seepage conditions, the events described here represent sustained or intense precipitation capable of saturating both engineered and surrounding agricultural ground. As such, they offer a test condition for evaluating:

- the behaviour of the NW egress margin under full loading,

- the performance of installed mitigation measures,
- the continuity (or discontinuity) between pad perimeter water expression and adjacent land.

The following subsections present these events chronologically. Each event is documented using contemporaneous imagery and video where available. Observations are confined to visible surface behaviour and spatial relationships.

4.1 October 2017 Event

The October 2017 rainfall event represents the first sustained fluvial loading episode during active drilling operations documented in this report. Imagery from 25/10/2017 shows widespread saturation across the pad perimeter and adjacent agricultural land.

Figure 46 - DJI_0045 - Oblique aerial view of the pad looking approx. East

At the NW margin, multiple tonal variations are visible within surface water and along the perimeter slope. Surface pooling extends across both engineered and natural ground, allowing direct observation of boundary behaviour under full hydrological loading.

This event establishes the baseline response of the NW margin under intense precipitation. The event therefore provides a reference condition against which subsequent hydrological behaviour can be compared.

Figure 47 - DJI_0070 - NW margin, Water levels approach the upper boundary of the engineered perimeter, with freeboard visibly reduced relative to drier conditions.

Figure 48 - DJI_0066 - NE margin - several locations standing water corresponding to undulations along fence line.

In the Figure above, on the external boundary, a sheet-like white material is visible outside the NE margin, approximately opposite the previously identified seam location where gravel was weighing a seam which was ponded, prior to welding. The material exhibits collapse and sediment loading inconsistent with highly mobile lightweight debris. While the material cannot be conclusively identified from imagery alone, its spatial alignment with the earlier seam zone is noted

Figure 49 - DJI_0073 - White material at boundary interface between perimeter surface and engineered mound.

Looking at the ingress zones from previous sections is useful in assessing the full hydrogeological situation at this time. Zone B is saturated, the colour of the fluid is dark and similar to the fluid on the pad. Two lines of sand bags are in place, suggesting ingress mitigation attempts.

Figure 50 - DJI_0085 - Zone B ingress with two lines of sand bags placed.

Zone A also presents with a turbid fluid during the October 2017 flood event. Internally, irregular patches of coarser gravel became visible beneath shallow inundation near the Zone A ingress boundary. These patches contrast in texture and tone with surrounding pad material and appear clustered adjacent to the perimeter fence line. Concurrently, the fluid tone in this boundary zone differs from that observed further inward on the pad surface. The distribution and grading variation are spatially structured rather than uniform, consistent with localised surface reworking under hydraulic loading conditions.

Figure 51 - DJI_0098 - Zone A has turbid red/brown fluid pooled. Inside the perimeter, irregular and raised gravel patches are pre present. Fluid in this location is lighter than the surrounding water on the pad.

Membrane Tonal Response Following Rainfall (28 October 2017)

Comparison of UAV imagery captured approximately 13 hours apart (pre- and post-rainfall) shows a marked tonal change along the inner membrane at the NE corner of the pad.

In the earlier image (pre-rainfall), the membrane at the east corner pad interface appears relatively uniform in tone. In the subsequent image captured following rainfall, the same section exhibits a continuous, darker band aligned along the seam.

Figure 52 - Comparison between 27/10/17 (DJI_0215 - left) and 28/10/17 (DJI_0206 - right) Membrane changes tone at interface with pad level. External soil disturbance also changes in this 25 hour period.

There are further dark patches of membrane along the NE margin. Each patch visible:

- Is linear and boundary-conforming
- Follows the membrane–soil interface
- Is spatially coincident with areas of internal ponding

Does not appear as a diffuse or randomly distributed wet patch

The tonal shift is therefore consistent with moisture loading or surface wetting concentrated along the seam geometry rather than uniform surface saturation.

No breach or structural failure can be concluded from imagery alone. However, the membrane's boundary-aligned tonal response under rainfall loading indicates that this interface may behave as a preferential moisture pathway under rainfall loading.

This observation is relevant to the interpretation of subsequent external wetness patterns documented along the adjacent margin.

4.2 November 2017 Event

A subsequent rainfall episode on 23/11/2017 resulted in renewed saturation across the site and surrounding fields. Compared to October imagery, the November event provides additional evidence of how surface water accumulates and redistributes at the NW egress margin following repeated loading.

Figure 53 - DJI_0018 - Oblique aerial view of the site looking south.

Widespread standing water is visible across the surrounding agricultural fields, indicating regional saturation conditions. Surface pooling is also present within the engineered pad footprint. The NW margin appears visibly darker than adjacent boundaries, with water accumulation extending along the perimeter interface. The broader landscape context confirms that this event represents a catchment-scale hydrological loading episode rather than isolated on-site ponding.

Temporary fencing and localised excavation are visible near the NW margin saturated area during this period. The margin again exhibits pooling in a constant tone.

Figure 54 - DJI_0020 - Oblique aerial view looking south-east.

Standing water is visible to the east of the site within adjacent agricultural land, forming pools in locations consistent with mapped flood-prone areas. Within the pad boundary, surface pooling persists along the NW margin. The inundated areas display a largely uniform creamy-brown tone under saturated conditions. Temporary fencing and a small area of localised ground disturbance or excavation are visible near the saturated section of the NW boundary.

The site is fully saturated by this event. A new grade of gravel has been added to the surface surrounding the drilling rig; this can be seen above the water level in some places. Dark fluid patches and gaps between the fence line and external soil can be seen on the NE margin.

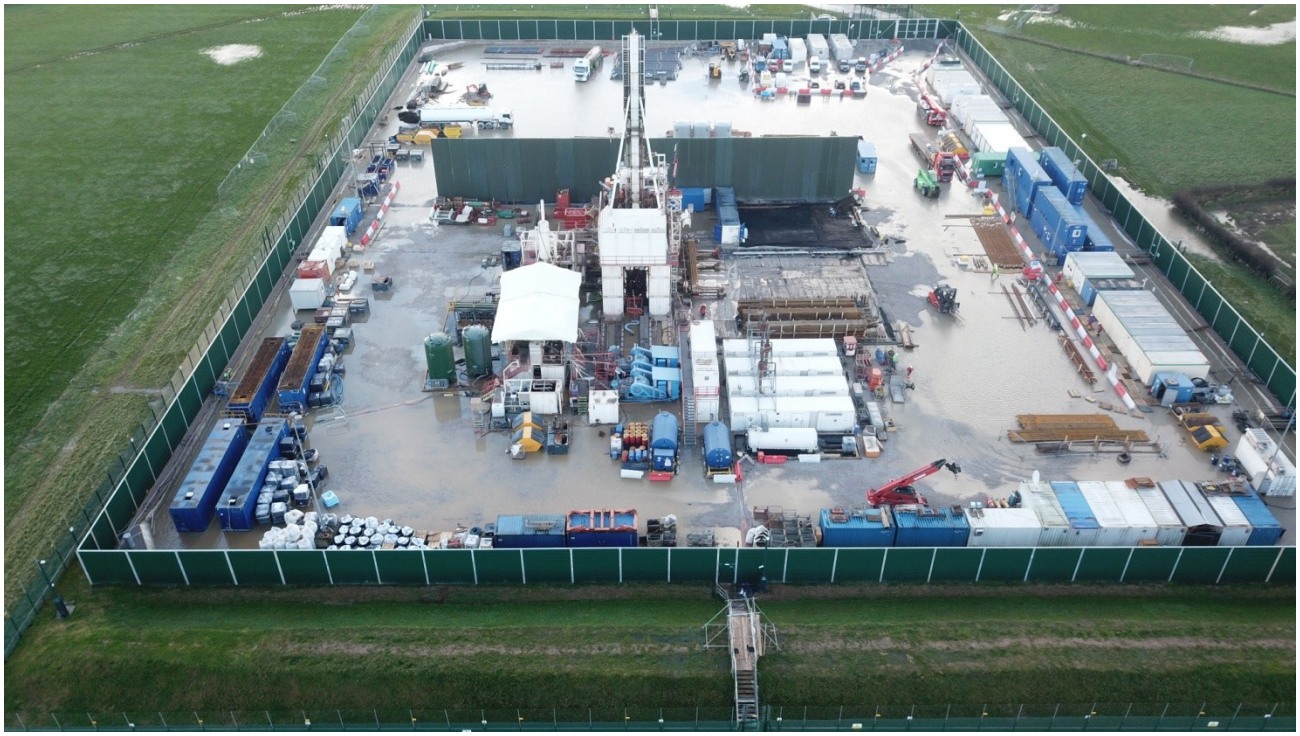

Figure 55 - DJI_0025 - The site appears broadly inundated during the November 2017 rainfall event. Surface water covers most operational areas, with only isolated raised surfaces remaining exposed.

Around the drilling rig, a lighter-toned gravel layer is visible above the surrounding water level in several locations. This material differs in colour and texture from adjacent pad surfacing and appears to have been placed on top of the pre-existing surface. The elevation difference between this gravel and surrounding inundated areas allows its outline to remain discernible under flood conditions.

Along the NE margin, darker patches of surface fluid are visible adjacent to the internal fence line. In places, narrow linear separations between the fence base and the external soil surface can be observed. These features are spatially confined to the boundary interface and contrast with the more uniform inundation visible elsewhere on the pad.

The NE margin has external pools of fluid in apparent depressions adjacent to dark patches on internal membrane interface.

Figure 56 - DJI_0026 - External pooling along the NE margin is visible in shallow depressions immediately beyond the perimeter. These locations are spatially aligned with darker tonal bands along the internal membrane–soil interface. At the NW margin, gravel is visible at or above the crest line of the internal perimeter bank.

At the east corner of the pad, a visible gap is present between the internal fence line and the adjacent soil surface. The soil in this area exhibits slight undulation and irregular surface contour. This zone corresponds spatially with areas of internal membrane darkening observed during the same rainfall episode.

Figure 57 - DJI_0031 - East corner detail. A visible gap is present between the fence line and adjacent soil surface. Localised soil undulation corresponds spatially with internal membrane darkening. Zone B is visible in the upper left of the image.

Zone A ingress presents with turbid standing water. The separation between the internal fence line and adjacent external soil appears more pronounced than in earlier imagery.

Figure 58 - DJI_0037 - Zone A ingress during the November 2017 flood event. Turbid standing water is present along the boundary interface. A clearly defined separation is visible between the internal fence line and adjacent external soil. Hydraulic loading remains concentrated along the perimeter zone under full site inundation.

The November 2017 event demonstrates that the hydrological behaviours observed in October were not isolated. Margin pooling, membrane tonal response, ingress turbidity and external depression formation recur under renewed rainfall loading. Surface modifications introduced between events remain partially emergent during inundation, indicating progressive adjustment of pad surface grading. Together, the October and November imagery establish repeatable boundary behaviours under sustained fluvial conditions, providing context for later operational flood responses.

4.3 September 2019 Event

The September 2019 event represents a later-stage fluvial episode occurring after mitigation measures had been installed along the margins.

Figure 59 - DJI_0045 - Oblique view of pad facing approx. East. New gravel drainage-like structures installed in the downslope field.

Imagery from 29/09/2019 shows elevated water levels extending across both the external margin and the pad interior. Surface water is present along the perimeter and within the engineered footprint. Contemporaneous imagery records tonal similarity between internal and external water bodies at the NW margin.

Figure 60 - DJI_0209 - NW margin. Internal and external fluids are similar in tone and turbidity.

Subsequent footage from September 2019 shows extension of surface water southward along the NW boundary before turning westward along existing drainage contours identified in LiDAR analysis.

Figure 61 - DJI_0183 - Surface water at the NW margin extending southward and turning westward at ground level along existing drainage contours.

Despite repeated high-intensity rainfall events documented in October and November 2017, surface water pooling along the NW margin does not visibly connect with the downhill western drainage channel at ground level. Across available imagery from those events, no continuous surface pathway is observed between the pad perimeter and the adjacent western drainage feature.

The 2019 event does not inundate the pad interior to the same extent as the 2017 episodes; however, external pooling occurs in locations consistent with those previously documented.

Figure 62 - DJI_0291 - Oblique view facing west. External pooling along the NW boundary corresponds spatially with earlier flood events.

Although interior water levels are lower than those observed during major 2017 flood events, turbid water remains present along the pad margins. The tonal and textural characteristics are consistent with previously documented ingress and egress boundary conditions.

Figure 63 - DJI_0296 - Top-down view oriented NW. Water pooling at the east corner and turbid fluid along the interior margins. External pooling exhibits tonal similarity to adjacent internal water bodies.

Comparative imagery from October 2017 shows shallow, localised surface water at the NW boundary without visible surface-level continuity to the western drainage channel. By contrast, October 2019 imagery documents a more pronounced and laterally continuous surface pathway extending westward along the established drainage contour. The transition from isolated pooling to visible surface connectivity is documented here without inference as to mechanism.

Figure 64 - NW margin - October 2017 (left DJI_0028) and September 2019 (right DJI_0183) showing surface connectivity in 2019 not visible in 2017 imagery.

Taken together, the documented October 2017, November 2017, and September–October 2019 events demonstrate recurring, spatially structured hydrological responses at the pad perimeter under fluvial loading. Margin pooling, tonal response at membrane interfaces, turbidity at ingress zones, and external depression formation recur across independent rainfall episodes.

These events are not exhaustive of all flood occurrences but have been selected to illustrate consistent behavioural patterns and their evolution through time. The recurrence of boundary-aligned responses under varying rainfall magnitudes provides a comparative framework for interpreting subsequent site conditions.

5. Well Cellar

The well cellar forms the primary sub-surface interface between the well structure and the engineered pad containment system. This section documents the observable evolution of the cellar area from early construction through subsequent operational phases. Observations are presented chronologically, beginning with pre-membrane construction conditions.

Figure 65 - DJI_0004- 09/04/17 - Early image showing well cellar excavation during construction phase.

Early construction-phase image of the well cellar excavation. A linear, irregular disturbance is visible within the exposed soil profile at the base of the excavation. The feature exhibits a crack-like morphology with adjacent disturbed material.

On 09/04/17, during early-stage excavation of the well cellar, the stepped excavation profile is clearly visible. Within the exposed soil at the base of the excavation, a narrow, irregular, linear disturbance is present. The feature appears discontinuous and locally widened, with surrounding soil exhibiting a disturbed texture relative to the adjacent excavation surface. No clear pooling or surface sheen is visible in this image.

Figure 66 - External Image - 17/04/18 - Well cellar following installation of the concrete base slab. Tonal variation is visible across the concrete surface, forming irregular surface patterns.

Note: "External Image" denotes imagery sourced from third-party archival material. Original file retained in downloaded state. Date retained as archived.

On 17/04/18, following installation of the concrete base slab within the well cellar, the excavation is visible with stepped earth walls and perimeter containment fencing. The concrete base exhibits irregular tonal variation across its surface. The variation forms diffuse and locally concentrated surface patterns without clear linear cracking visible at this resolution.

The early construction image (Figure 66) captures the cellar excavation phase prior to installation of the concrete base. The visible disturbance in the surrounding soil - including a crack-like linear feature and adjacent zones of irregular compaction - indicates that the subgrade was already undergoing differential movement or localised moisture redistribution during excavation. The following image, taken approximately five weeks later, provides the first view of the completed concrete base and immediate surrounding surface conditions.

By 16 May 2017, the cellar concrete base is in place. The wider site surface appears saturated, with pooled water evident across the clay subgrade. At the northern corner of the cellar structure, a grey-toned surface feature is visible, texturally distinct from adjacent soil. Its tone and morphology differ from the surrounding compacted clay, suggesting either material deposition or differential moisture interaction.

To the east of the cellar, a circular surface feature is visible which does not appear flush with the surrounding ground plane. The boundary is visually defined and differs in texture from adjacent soil, indicating either localised compaction, settlement, or material disturbance.

No definitive interpretation is made at this stage; however, these features are recorded due to their spatial relationship with the cellar structure and subsequent observations in later imagery.

Figure 67 - DJI_0006 - 16/05/17 - Well cellar under construction. The site surface appears saturated with visible pooling in multiple areas. A grey-toned deposit is visible at the north corner of the cellar interface. A circular tonal variation is visible to the south-east of the cellar footprint and appears texturally distinct from surrounding soil.

Following completion of the cellar base and installation of surrounding infrastructure, subsequent imagery captures the site during active drilling operations. These later images allow assessment of surface conditions under operational loading, including the presence of pooled fluids, staining, and drainage interventions. Observations below are limited to visible surface expression and spatial patterning.

Figure 68 - Well pad during early operational phase. Surface pooling and brown staining visible extending laterally from the well assembly toward the southern and eastern pad margins.

The image shows extensive surface pooling across the liner system, with brown-toned liquid distributed downslope from the drilling assembly. Fluid accumulation is not confined to the immediate footprint of the rig but extends laterally across the pad surface, approaching the internal fence line boundary.

The staining pattern appears consistent with shallow sheet flow over a graded liner surface. Tonal variation follows subtle surface gradients rather than discrete point discharge alone. Brown discolouration is visible along low points and seam-adjacent areas, indicating repeated or sustained fluid presence rather than isolated splash events.

A trench cut into the pad surface is visible to the left of frame. Its alignment and position are consistent with temporary drainage intervention. The trench interrupts otherwise uniform pad grading, suggesting reactive surface water management during this period.

The pooled liquid exhibits visual similarity in colour to fluids contained within on-site tanks and skips; however, the origin cannot be determined from imagery alone. The observable fact is lateral migration across the engineered liner surface.

Relative to earlier construction-phase imagery, this frame captures the transition from excavation and soil disturbance to operational loading conditions. Surface fluid management appears active, and accumulation is spatially significant when viewed against the fence line boundary.

The following image captures the well pad under operational loading conditions. Widespread surface staining and pooling are visible across the liner system, particularly concentrated downslope of the well assembly and extending toward the southern perimeter.

Figure 69 - External image – 02/07/17 – Well pad during active operations. Extensive surface staining and fluid accumulation visible across liner surface.

Fluid presence is not confined to a discrete spill footprint. Instead, staining appears diffuse and laterally distributed, consistent with shallow sheet flow over a graded surface. Multiple tonal zones are present: darker pooling in low areas, lighter dried residues in adjacent zones, and irregular margins suggesting repeated wetting and drying cycles.

Accumulation is visible along internal berms and near the southern boundary channel. The continuity of staining toward the fence line suggests that pad grading directs flow outward from the well area rather than retaining it locally.

The spatial extent of discolouration exceeds the immediate operational footprint of individual equipment items. White granular material visible near the central assembly may represent absorbent deployment; however, the origin and composition of surface fluids cannot be determined from imagery alone.

Relative to earlier frames, this image reflects sustained surface fluid management activity rather than isolated events. The observable condition is lateral migration across the engineered liner surface during active operations.

Figure 70 - DJI_0009 - 09/08/17 - Operational phase. Widespread pooling and flow patterning across pad surface.

This image captures the pad during active operations with extensive surface fluid present. Brown-toned liquid is distributed across a large proportion of the engineered surface, forming shallow pooled areas interlinked by narrow, linear flow paths.

Distinct channel-like features are visible within the pooled fluid. These appear as lighter-toned streaks and sinuous lines cutting through darker accumulations, consistent with shallow overland sheet flow responding to micro-topography within the graded liner system.

The northwest perimeter ditch exhibits a darker, more uniform fluid tone relative to the pad surface. The colour difference suggests either differing sediment load, residence time, or fluid composition between the containment channel and the active pad surface.

The southeast margin appears comparatively drier. This spatial contrast may reflect:

- differential compaction from vehicle traffic,
- localised grading,
- subsurface stiffness variation,

- or preferential drainage direction across the liner.

Importantly, fluid distribution is not random. The pooling pattern follows a coherent hydraulic logic, with visible convergence toward lower margins and boundary interfaces.

At this stage of operations, the pad behaves as an exposed hydrological surface rather than a dry, impermeable platform. The observable condition is consistent with repeated wetting events and lateral redistribution across the engineered system.

The following image, taken during rig decommissioning, shows multiple areas of surface staining and fluid accumulation across the former drilling footprint. Brown, green and black toned liquids are present within shallow depressions corresponding to the position of previously installed equipment.

Figure 71 - DJI_0258 – 02/08/18 – Decommissioning phase. Surface discolouration and fluid accumulation within equipment depressions.

Several rutted zones retain pooled fluid. The depressions appear to follow the footprint of heavy plant and modular rig components. Along the margins of these indents, raised gravel ridges are visible. These may indicate:

- localised compaction of underlying material resulting in settlement adjacent to wheel loads,
- displacement and heaping of aggregate during removal of equipment,
- or redistribution of gravel to regrade disturbed areas.

In each case, the geometry implies modification of the engineered surface during and after drilling operations.

Fluid within these depressions appears darker and more saturated than surrounding surface dampness. The distribution pattern is not uniform across the pad; rather, it follows structural and mechanical disturbance lines.

The persistence of stained areas at the former rig location suggests repeated wetting and retention rather than a singular rainfall event.

The visual presence of drilling-related fluids on the pad surface during decommissioning is notable in the context of subsequent waste classification and management discussions. The fluid distribution observed here will be referenced in the A1 waste analysis section.

Figure 72 - DJI_0224 – 09/08/18 – Fresh gravel placement and localised excavation adjacent to well cellar

Fresh gravel has been placed across portions of the pad surface, with a distinct mound visible to the north-west of the well cellar. An excavator is positioned along the NE margin of the cellar footprint, indicating active surface reworking at the time of capture.

Close inspection of the cellar perimeter shows persistent tonal darkening along the immediate margins. This darkening is spatially consistent with earlier observations and appears concentrated along the interface between the cellar structure and surrounding pad surface.

The newly placed gravel differs in colour and texture from the underlying surface, suggesting either resurfacing or localised remediation. The interaction between fresh aggregate, existing pad material, and visible damp zones is notable, particularly where gravel appears to have been placed adjacent to areas previously exhibiting moisture staining.

The cellar interior itself shows darker zones along the inner perimeter, consistent with retained moisture or surface dampness. Standing water is visible on the NW margin of the well cellar, tonal variation remains spatially coherent with previously documented damp margins.

Figure 73 - DJI_0058 – 14/08/18 – New fluid emergence in previously gravelled areas; moisture present along NW well margin

Fresh surface water is visible in areas that had previously been re-gravelled. Pooled fluid appears along the north-west margin of the well cellar and across portions of the pad surface where recent disturbance is evident.

Surface disturbance from plant movement is visible, with compacted wheel paths forming shallow depressions that appear to be acting as collection channels.

The recurrence of moisture in an area recently covered with fresh aggregate indicates that the water expression is not limited to original surface grading conditions.

A linear darkened strip runs along the NW edge of the cellar boundary, consistent with repeated wetting or preferential flow along that margin. The interface between the temporary working mats and the gravel shows tonal variation suggestive of moisture tracking along the contact zone. The gravel immediately upslope of the pooling appears lighter and recently placed, while darker bands mark saturated zones downslope. The fluid appears to be emerging through or along the gravel interface rather than uniformly across the surface, the pooling is spatially constrained to the NW margin and adjacent disturbed gravel, rather than being evenly distributed across the pad.

The following image is from between the fracking of wells PNR-1z & PNR-2.

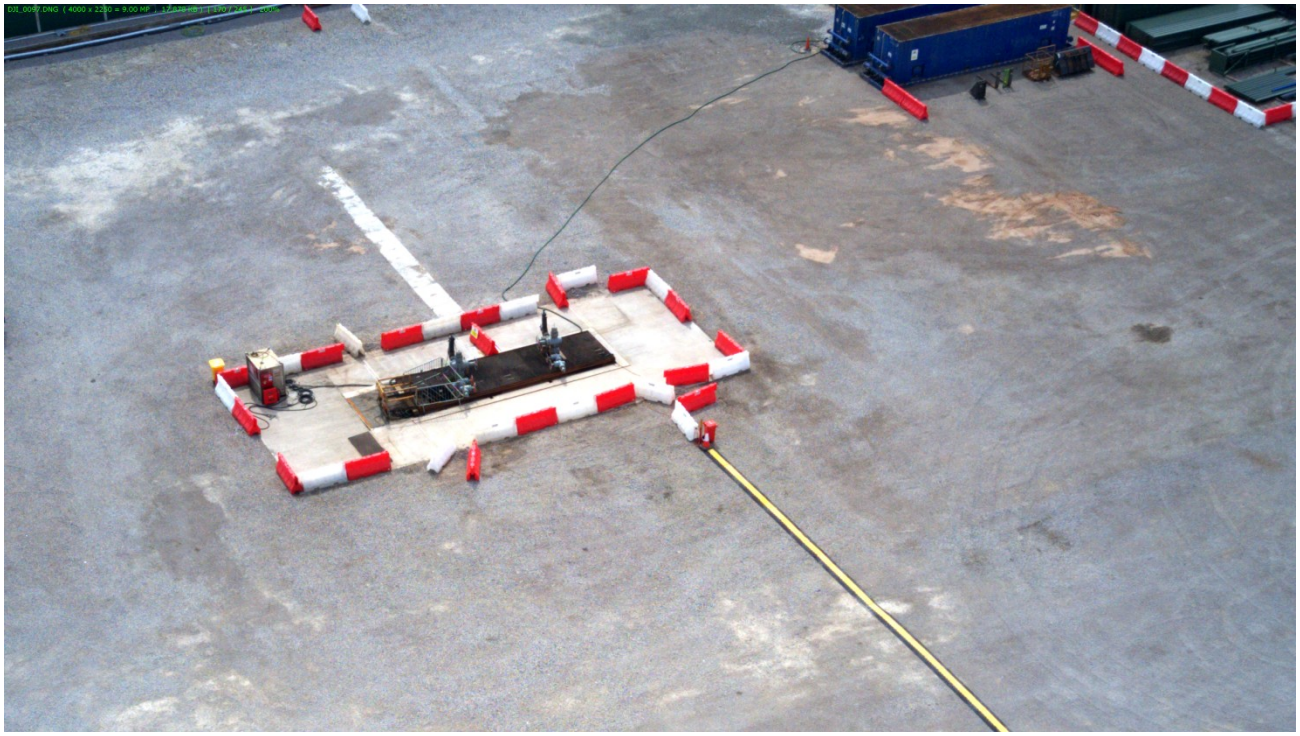

Figure 74 - DJI_0097 – 23/05/19 – Well cellar (NW margin) showing wet aggregate, localised staining and surface disturbance.

The NW margin of the well cellar exhibits visible darkening consistent with surface moisture. The aggregate in this area appears redistributed relative to the surrounding pad surface, with coarse material exposed and finer gravel displaced.

A clay-like stain is visible to the south of the cellar perimeter, distinct in tone from the surrounding gravel matrix. A darker, discrete patch is also present nearby. These features occur within previously gravelled areas and contrast with the drier, more uniform sections of the pad.

The wetting pattern is localised rather than uniform across the surface, and appears to originate adjacent to the cellar margin rather than from broader pad-wide saturation. The disturbance to the aggregate suggests either subsurface movement affecting the gravel layer or repeated surface intervention at this location.

Figure 75 - DJI_0036 – 09/07/24 – Localised wetting and dark staining visible along the NW margin of the well cellar. The metal plate covering the cellar appears raised on one side. Pooling persists despite no widespread surface water visible elsewhere on the pad.

The NW margin of the cellar exhibits persistent darkened zones consistent with retained moisture. Adjacent aggregate appears redistributed and uneven, with tonal variation indicating repeated wetting and drying cycles. The cellar cover plate is visibly lifted along one edge, suggesting either differential settlement beneath or surface displacement of the slab interface.

Localised pooling is present at the cellar interface despite the broader pad surface appearing comparatively dry.

Figure 76 - DJI_0071 – 09/07/24 – Oblique site view showing absence of widespread surface pooling within the surrounding landscape.

The sequence now shows:

- Initial soil disturbance and crack-like features (April–May 2017)
- Widespread surface pooling during drilling operations (June–August 2017)
- Persistent moisture presence adjacent to cellar margins
- Subsequent gravel placement and localised excavation (August 2018)

The surface management response - addition of gravel and targeted excavation - introduces further heterogeneity to the pad stratigraphy, with implications for drainage behaviour and subsurface hydraulic connectivity.

Figure 77 - DJI_0581 – 17/03/25 – Decommissioning rig positioned over the well cellar. Surrounding gravel appears locally raised relative to the cellar surface, with scattered dark patches visible within the aggregate.

The gravel apron surrounding the cellar appears elevated relative to the concrete cellar slab, creating a subtle but discernible relief difference at the interface. Darkened zones within the gravel are visible in multiple locations adjacent to the cellar footprint. These tonal variations are spatially associated with the well position rather than being uniformly distributed across the wider pad surface.

The raised aggregate and localised staining are present during decommissioning works and follow earlier documented phases of wetting and aggregate redistribution.

Figure 78 - DJI_0072 – 28/05/25 – Well backfilling phase

Oblique view during well backfilling operations. Fluid is visible around the cellar perimeter and across portions of the pad surface. No standing water is visible beyond the site boundary in the surrounding agricultural land at the time of capture.

Gravel distribution around the cellar appears uneven. On the SE margin, gravel appears to overtop the concrete cellar surround. On the NW margin, aggregate appears raised relative to the adjacent pad surface, forming a subtle lip or ridge.

In the zoomed view, darker staining is visible immediately adjacent to the cellar edge, with tonal contrast between dampened gravel and surrounding lighter aggregate. The staining appears concentrated along the interface between concrete and gravel.

The aggregate redistribution pattern suggests recent disturbance or movement in the immediate cellar perimeter. The mechanism for this redistribution is not determinable from the image alone; however, the differential levels between cellar surface and surrounding gravel are visually apparent.

Fluid presence is again localised to the cellar vicinity rather than uniformly distributed across the wider pad.

Figure 79 - DJI_0476 - 26/12/25 – Post-decommissioning surface condition. Green vegetative growth and surface water pooling evident around the former well cellar. Irregular staining and sediment redistribution form interconnected moisture patterns extending beyond the cellar footprint, consistent with sustained damp conditions rather than isolated rainfall.

The spatial arrangement of vegetation, staining and surface water pooling suggests sustained moisture retention and micro-topographic modification in the vicinity of the former well cellar. The morphology of these features is consistent with repeated wetting and sediment redistribution rather than isolated rainfall events.

Figure 80 - DJI_0280 – 9/2/26 – Post-decommissioning, light rainfall

Following light rain, surface water accumulation across the pad is visibly increased relative to the previous image, with shallow pooling extending beyond previously identified wet zones. Notably, fresh water appears up-gradient (east & south of the cellar) compared to earlier staining patterns, suggesting altered micro-topography or subsurface moisture expression rather than simple downslope runoff.

The NW perimeter drain remains comparatively dry, indicating that water is not preferentially migrating toward the edge drainage infrastructure.

Close inspection of the cellar area shows persistent dampness along the NW concrete margin, with staining radiating outward into the surrounding aggregate. The distribution pattern is diffuse rather than channelised, and the surrounding gravel exhibits tonal variation consistent with sustained moisture retention rather than transient surface runoff alone.

5.1 Section Closing Statement – Surface Observations

The preceding figures document progressive changes to surface condition in and around the well cellar area from drilling through to post-decommissioning. The imagery demonstrates repeated patterns of moisture expression, aggregate redistribution, staining, and localised ponding that warrant consideration in the context of site stability and surface management.

This document has intentionally avoided detailed hydrological interpretation of the finer surface water features visible across the pad. While multiple drainage patterns, tonal variations, and micro-topographic indicators are present in the record, full analysis of these elements would materially expand the scope of this report and reduce overall readability.

It should also be noted that the figures included here represent a curated subset of a significantly larger temporal dataset. Additional aerial coverage exists across multiple years and seasonal conditions. That broader archive can be made available upon request should further technical review be required.

6. LiDAR Elevation Differencing (2018–2022)

Airborne LiDAR datasets for the Fylde were obtained for two survey epochs (2018 and 2022) from the UK Government National LiDAR Programme and processed in QGIS in OSGB36 / British National Grid (EPSG:27700). Point cloud tiles were mosaicked per epoch and rasterised to a common grid. The 2018 surface was then subtracted from the 2022 surface to generate a continuous raster of relative elevation change ($\Delta z = z\_2022 - z\_2018$). Positive values indicate relative elevation gain and negative values indicate relative elevation loss over the interval.

This section documents the magnitude, spatial organisation, and continuity of the resulting Δz field. Interpretation is limited to the presence and geometry of relative surface change; no subsurface mechanism is inferred. A conservative threshold of ≤ -0.06 m is applied in subsequent figures to identify zones where negative change exceeds background variability. Internal pad areas subject to operational surface modification are excluded from quantitative interpretation.

The processing workflow described above (tile selection, rasterisation, subtraction, and threshold extraction) was applied consistently across the study area. All maps presented in this section are derived directly from the differenced raster without smoothing or interpretive enhancement beyond standard visualisation.

Regional Context (Figure 82)

The Fylde-wide Δz raster provides regional context for subsequent site-focused analysis. At peninsula scale, the differencing product exhibits broad areas of near-zero change interspersed with spatially organised bands of positive and negative Δz. Several of these bands extend across multiple land parcels and are not constrained by individual field boundaries, indicating that the mapped signal reflects a spatially coherent pattern rather than isolated, field-specific variation.

The Preston New Road (PNR) site is located within one such organised Δz field and is therefore examined in the sections that follow as a local case study nested within the regional differencing product.

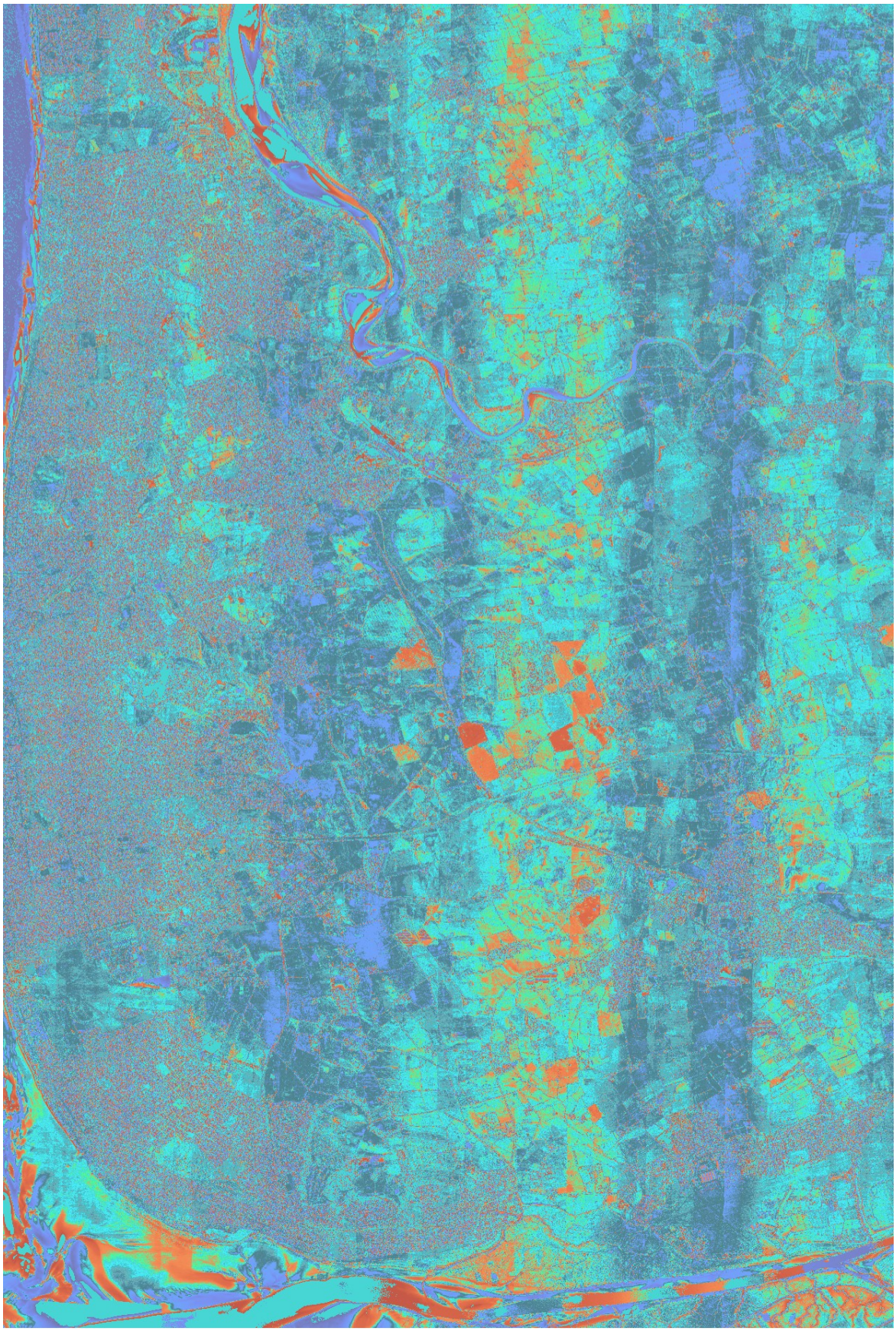

Figure 81 (Page 88) - Regional LiDAR elevation change raster (Δz = z_2022 − z_2018), Fylde peninsula. Colours show relative elevation gain (positive Δz) and relative elevation loss (negative Δz) between 2018 and 2022, displayed at peninsula scale to provide context for subsequent site-focused figures. The map illustrates that the Δz field includes spatially organised bands extending across multiple land parcels (i.e., not field-bound in geometry). This figure is used for regional orientation only; no interpretation of mechanism is made at this scale.

At both peninsula and local scales, the Δz raster exhibits spatial patterning that is not confined to individual field boundaries. Linear striping artefacts are visible in several areas and correspond to airborne LiDAR flight line acquisition geometry, reflecting differences in scan angle, overlap, and interpolation across survey swaths. These artefacts are visually distinguishable from broader, spatially coherent Δz patterns that extend across multiple land parcels.

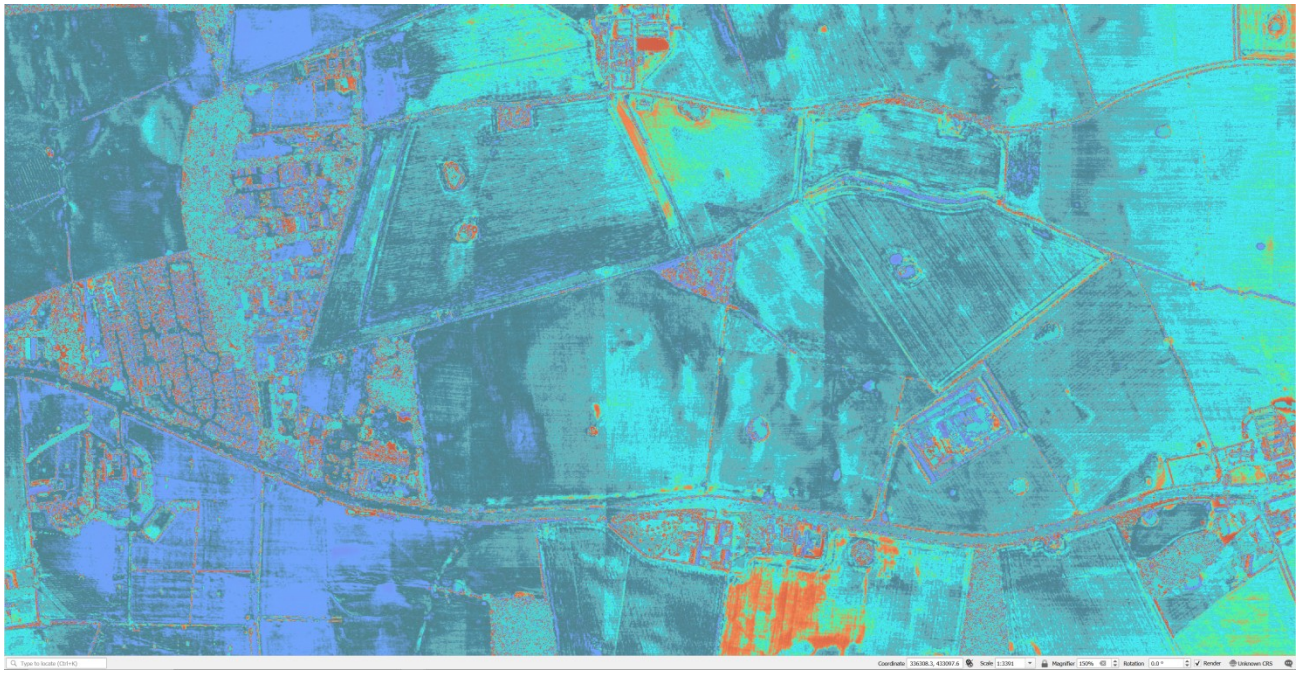

Figure 82 - Local LiDAR elevation change raster (Δz = z_2022 − z_2018) centred on the Preston New Road site and well pad.

Colours represent relative elevation gain (positive Δz) and relative elevation loss (negative Δz) between survey epochs. Linear striping visible across parts of the image reflects LiDAR flight line acquisition geometry and interpolation differences between overlapping swaths. These acquisition artefacts are distinct from broader, spatially coherent Δz patterns extending across multiple land parcels and drainage features.

To distinguish minor interpolation variability from more substantial negative elevation change, a threshold of ≤ −0.06 m was applied to the Δz raster. Cells meeting or exceeding this magnitude of relative elevation loss were extracted to form a binary polygon layer representing discrete clusters of negative change.

Figure 84 - Local Threshold Extraction

Figure 84 presents this threshold extraction over the local area surrounding the Preston New Road site. The resulting polygons illustrate the spatial organisation of negative Δz exceeding −6 cm. These clusters are distributed across multiple land parcels and are not confined to individual field boundaries. The geometry of several clusters exhibits lateral continuity beyond isolated single-cell artefacts.

No interpretation of mechanism is made. The extraction is presented solely to demonstrate the magnitude and spatial coherence of relative elevation change exceeding the defined threshold.

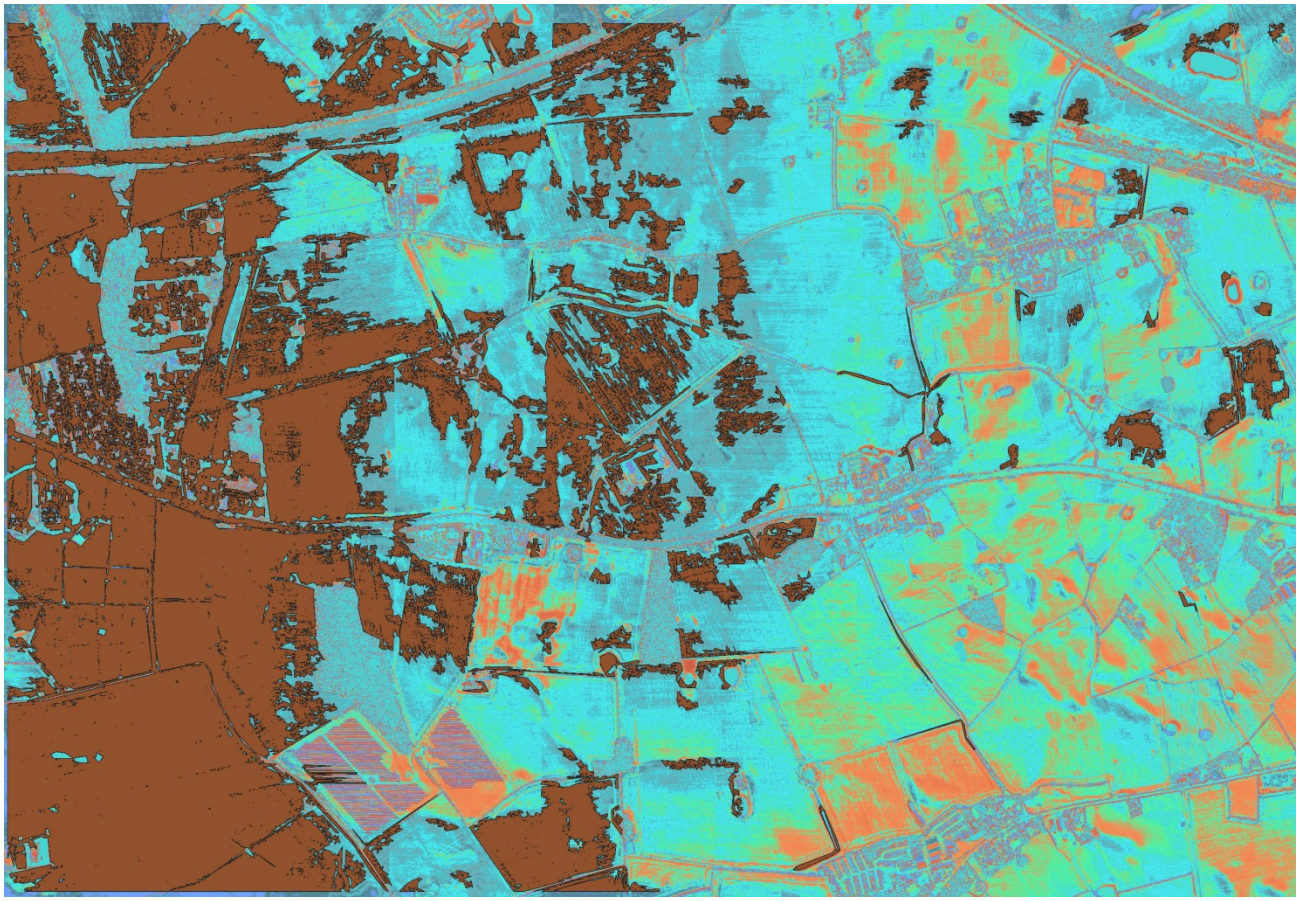

Figure 83 - Threshold extraction of negative elevation change ($\Delta z \leq -0.06$ m), local area surrounding Preston New Road.

Brown polygons represent areas where relative elevation loss between 2018 and 2022 exceeds 6 cm. The extraction is derived directly from the differenced raster without smoothing. Clusters extend across multiple land parcels and are visually distinguishable from linear LiDAR flight line artefacts. The figure illustrates magnitude-defined spatial organisation only.

Figure 85 - Close Pad View

A closer view of the threshold extraction centred on the Preston New Road pad is presented in Figure 85. Within the engineered pad footprint, the extracted polygons exhibit irregular and fragmented geometry. This pattern is consistent with operational surface modification between survey epochs

(e.g., equipment placement, hardstanding adjustment, and surface grading), which can introduce sharp local Δz contrasts unrelated to broader ground response.

In contrast, the surrounding agricultural fields exhibit more spatially coherent clusters of negative Δz. These clusters are not confined to individual field boundaries and display lateral continuity beyond the immediate pad perimeter. The pattern initiates slightly east of the pad footprint and extends westward as a corridor-like band of negative change. Additional narrow bands of negative Δz are visible along linear landscape features, including drainage channels and a narrow strip north of Preston New Road (A583).

The extraction is presented to illustrate magnitude-defined spatial organisation of relative elevation loss. No attribution of mechanism is made.

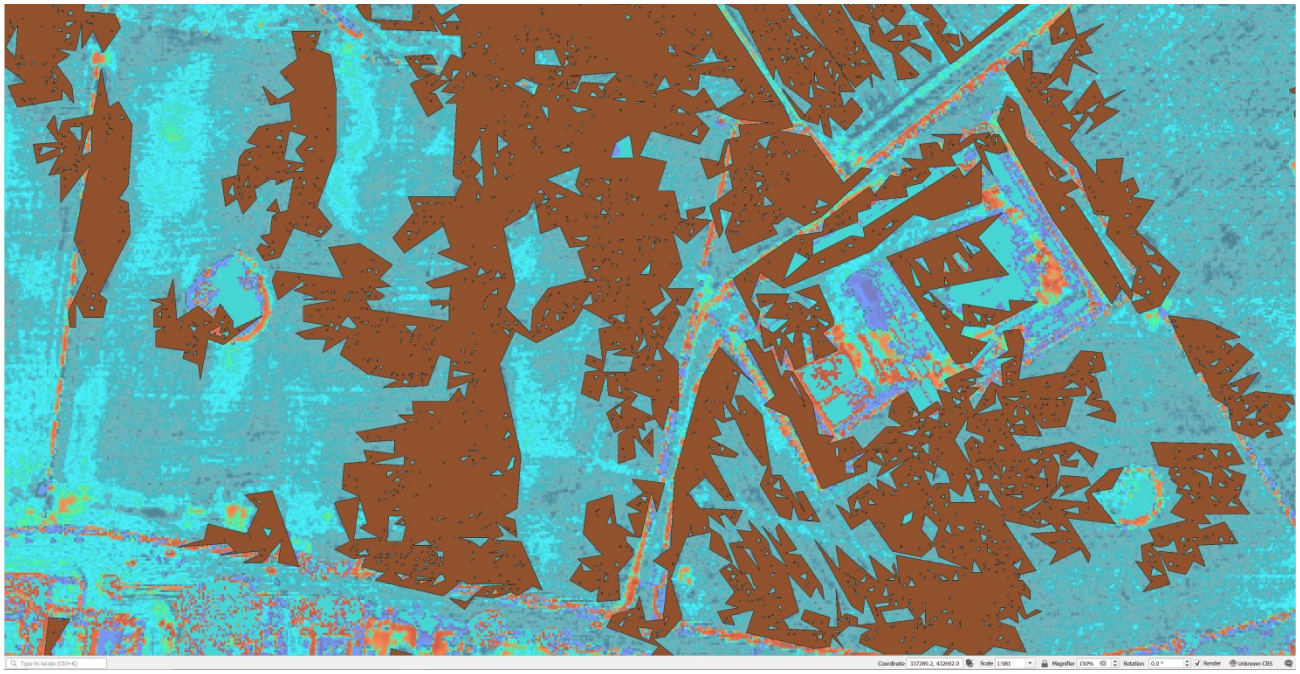

Figure 84 - Threshold extraction ($\Delta z \leq -0.06$ m) centred on the Preston New Road pad.

Irregular polygon geometry within the engineered pad footprint reflects operational surface modification between survey epochs. Surrounding agricultural fields display more spatially coherent clusters of negative Δz that extend laterally beyond the pad boundary. Linear alignments along drainage and roadside features are visible. The figure illustrates magnitude-defined spatial organisation only.

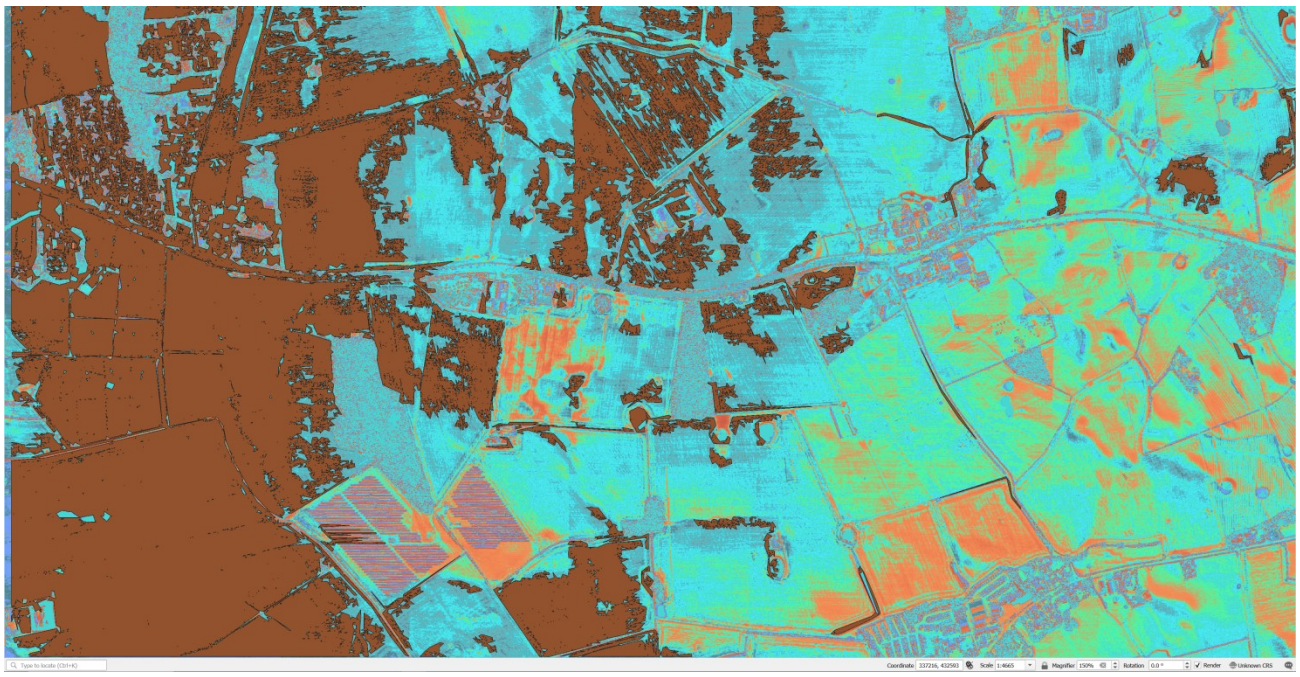

Figure 85 - Expanded Corridor View

Figure 86 presents a slightly expanded view of the threshold extraction surrounding the Preston New Road site. At this scale, the negative Δz clusters display clearer spatial organisation. A corridor-like band of relative elevation loss is visible extending westward from the vicinity of the pad and continuing beyond adjacent field boundaries. To the east, narrower bands of negative Δz are visible north of Preston New Road (A583) and along adjacent drainage features.

The spatial continuity of these bands is more apparent at this scale than in the close pad view. The geometry is not confined to engineered surfaces and extends into surrounding agricultural land. The pattern therefore reflects a broader spatial field of relative elevation change rather than isolated pad-internal artefact.

No causal interpretation is made.

6.1 Contextual Framing

The LiDAR differencing analysis presented in this section is intended as a structured screening tool rather than a diagnostic conclusion. It identifies areas where relative surface elevation change exceeds background variability and where spatial organisation is observable across multiple land parcels. The analysis does not determine mechanism or causation. Its purpose is to establish whether measurable surface change is present in proximity to the Preston New Road site and to provide a geospatial context for the ground observations documented in subsequent sections.

6.2 Limitations of LiDAR Differencing

LiDAR surface differencing provides a screening-level method for identifying relative elevation change between survey epochs. The results presented in this section are subject to inherent limitations of airborne LiDAR acquisition and raster interpolation, including flight line artefacts, edge effects at engineered boundaries, and the absence of independent vertical ground control verification within this analysis. Internal pad surfaces were modified during operational phases and are therefore unsuitable for deformation inference.

The extraction and mapping of Δz values are presented solely to document magnitude-defined spatial organisation of relative surface change. The analysis does not determine subsurface mechanism, rate of deformation, or causation. Where coherent patterns of negative elevation change are observed, these are identified as areas warranting independent professional geotechnical and hydrogeological assessment.

7. Pattern and Recurrence Analysis

The preceding sections document individual observations across multiple locations, operational phases, and hydrological events. This section synthesises those observations to assess whether the recorded behaviours represent isolated incidents or a spatially organised and temporally persistent pattern.

The analysis presented here remains confined to observable surface expression and mapped elevation change. No inference is made regarding subsurface mechanism. The purpose is to evaluate whether recurring features demonstrate structural coherence sufficient to warrant precautionary characterisation prior to disturbance.

7.1 Spatial Clustering

Across the observational record, surface wetness, fluid accumulation, sediment transport, and repeated surface modification are not randomly distributed across the pad perimeter. Instead, these behaviours cluster at specific and repeatable locations:

- The south-eastern margin (Zones A and B),
- The north-western margin (Zone C),
- The well cellar interface,
- The corridor extending westward from the pad boundary identified in the LiDAR threshold extraction.

The south-eastern boundary exhibits dual ingress-type behaviour at fixed geometric points. These locations demonstrate repeated ponding, fence interface irregularity, trenching, gravel installation, and subsequent surface reconfiguration across multiple years.

The north-western boundary exhibits outward flow alignment under fluvial loading conditions, sediment mobilisation, tonal variation, and recurring mitigation measures. This margin occupies the lowest structural boundary of the pad and overlies the area identified in pre-construction imagery as water-sensitive.

The well cellar interface demonstrates repeated localised wetting, aggregate redistribution, and tonal darkening across construction, operational, and decommissioning phases.

The LiDAR differencing analysis identifies a magnitude-defined cluster of negative elevation change spatially coincident with the north-western margin and extending westward beyond the pad footprint.

The recurrence of these expressions at fixed geometric coordinates indicates that the behaviours observed are spatially organised rather than incidental.

7.2 Temporal Persistence

The documented behaviours are not confined to a single operational phase or isolated rainfall episode. Instead, they recur across distinct temporal stages of the site lifecycle:

• Pre-membrane construction (early ponding and subgrade sensitivity),
• Active drilling operations (widespread surface fluid redistribution),
• Post-intervention phases (installation of gravel trenches and perimeter controls),
• Major rainfall events (October 2017, November 2017, September 2019),
• Decommissioning and post-decommissioning conditions (2024–2026 imagery).

The south-eastern ingress locations exhibit repeated modification across multiple years, including trench installation, gravel placement, barrier introduction, and continued surface patterning within the verge corridor.

The north-western margin demonstrates recurring saturation, sediment transport features, tonal variation, and repeated mitigation attempts under separate rainfall events spaced years apart.

The well cellar interface exhibits moisture persistence and aggregate redistribution across construction, operational loading, and decommissioning phases, including periods without widespread site inundation.

The LiDAR differencing product, derived independently of the photographic record, identifies elevation change over a four-year interval (2018–2022) that spatially coincides with areas of repeated observational expression.

Taken together, these observations indicate that the behaviours documented are not transient anomalies but represent persistent and evolving surface responses across time.

7.3 Boundary-Controlled Behaviour

A further characteristic of the documented pattern is its alignment with engineered boundaries and interface zones.

Surface wetting, staining, sediment transport, and repeated intervention are consistently concentrated along:

• Perimeter fence interfaces,
• Engineered berm slopes,
• Membrane–soil contact zones,
• The well cellar–aggregate interface,
• Marginal drainage features.

In contrast, large portions of the internal pad surface and surrounding agricultural land do not exhibit equivalent recurrence or structured modification.

This boundary alignment suggests that the observed behaviours are controlled by interface conditions rather than random surface processes. The geometry of expression follows structural transitions between engineered and natural ground.

This does not establish mechanism. It does, however, demonstrate that the pattern is spatially organised around defined boundary conditions and remains stable in its geometric focus across multiple years.

8. Hydrogeological Sensitivity and System Stability Under Disturbance

8.1 Current System State

The observational and LiDAR record indicates that the site exhibits persistent shallow hydraulic activity concentrated along defined boundary interfaces. Recurrent surface wetting, margin pooling, tonal variation at membrane–soil interfaces, and localised aggregate redistribution are documented across multiple operational phases.

The site is situated within a low-gradient coastal plain environment characterised by shallow drainage features and limited topographic relief. In such settings, minor changes in ground level or boundary configuration may influence local hydraulic routing.

The engineered pad introduced:

• A large impermeable surface,
• Modified surface grading,
• Perimeter berms and drainage controls,
• Concentrated loading associated with drilling operations.

The combined observational and elevation-differencing evidence indicates that shallow water expression has been repeatedly localised at specific margins and interfaces since installation of the engineered system.

This does not establish failure. It does establish that the site functions as an active hydro-mechanical system rather than a hydraulically inert platform.

8.2 Sensitivity to Disturbance

Removal of the engineered pad will necessarily alter the current hydraulic and mechanical configuration of the site. Deconstruction activities are likely to involve:

• Removal of surface loading and aggregate layers,
• Excavation of perimeter berms and drainage infrastructure
• Disturbance of subgrade previously subject to sustained wetting
• Alteration of surface gradients and recharge pathways,
• Modification of the existing stress regime surrounding the well cellar and casing system prior to verification of current integrity conditions.

Where shallow hydraulic processes are already active and spatially organised, such disturbance may modify groundwater–surface water interaction and alter localised settlement behaviour.

In low-gradient clay-dominated settings, removal of overburden can:

• Change effective stress distribution,
• Modify pore pressure conditions,
• Mobilise fines within softened zones,
• Alter preferential flow pathways previously constrained by engineered geometry.

The current configuration, while modified through repeated intervention, represents an evolved equilibrium between engineered structure and local hydrogeology. Premature disturbance risks resetting that equilibrium without first characterising its present state.

In addition to surface and shallow subgrade considerations, removal of loading and alteration of hydraulic conditions may influence stress distribution within the well cellar structure and associated casing system. Peer-reviewed geomechanical literature recognises that changes in effective stress, pore pressure, and boundary constraint can affect well integrity where casing and cement sheaths are present within deforming ground. This report does not assert that such effects are occurring at Preston New Road. However, where persistent surface and near-surface hydraulic expression has been documented, disturbance of the current stress regime without prior verification of well and subgrade condition introduces an avoidable uncertainty.

8.3 Consequences of Premature Deconstruction

If deconstruction proceeds without prior characterisation, several outcomes may follow:

• Loss of diagnostic surface patterns currently observable,
• Obscuring of elevation change features documented in LiDAR analysis,
• Redistribution of sediments and fines masking pre-existing conditions,
• Alteration of hydraulic gradients preventing retrospective assessment of baseline behaviour.

These outcomes would not necessarily create new instability; however, they would reduce the ability of the planning authority to determine whether the engineered system performed as intended throughout its lifecycle.

From a governance perspective, the question is not whether failure is imminent. The question is whether observable and spatially coherent ground behaviour has been adequately characterised before irreversible modification occurs.

8.4 Rationale for Characterisation Prior to Removal

Given the spatial clustering, temporal persistence, and boundary-controlled nature of the documented behaviours, a structured pre-disturbance characterisation would:

• Establish current subgrade condition,
• Verify membrane and interface integrity,
• Confirm shallow groundwater head conditions,
• Record surface geometry prior to removal of load and drainage controls.

Such characterisation would not presume fault or failure. It would simply ensure that the present condition of the site is documented and assessed before the engineered system is dismantled.

In environments where hydro-mechanical processes are active and spatially expressed, investigation prior to disturbance is proportionate, technically rational, and consistent with prudent planning oversight.

9. Supported and Unsupported Interpretations

The preceding sections document a structured observational and geospatial record. This section distinguishes between conclusions directly supported by the documented evidence and interpretations that remain under-constrained. The purpose is to clarify evidential boundaries and prevent overextension of inference.

9.1 Supported by Observational and Geospatial Evidence

The following points are directly supported by the documented imagery, mapping, and elevation differencing:

• Recurrent surface wetting and fluid accumulation at fixed perimeter locations,
• Repeated surface intervention at the same geometric coordinates (trenching, gravel placement, barrier installation),
• Persistent moisture expression at the well cellar interface across operational phases,
• Boundary-aligned tonal variation along membrane–soil interfaces during rainfall events,
• Spatial clustering of negative elevation change in the LiDAR differencing product coincident with observed surface expression zones,
• Temporal recurrence of hydrological expression across multiple independent rainfall events and across years.

These observations establish spatial organisation, temporal persistence, and interface sensitivity. They do not require interpretation of subsurface mechanism to be valid.

9.2 Plausible but Under-Constrained

The following interpretations are plausible given the observational and geospatial record, but cannot be conclusively determined from imagery and LiDAR differencing alone:

• Shallow groundwater redirection or concentration resulting from engineered boundary modification,
• Localised subgrade softening or consolidation in response to sustained wetting,
• Preferential flow along membrane–soil or fence–ground interfaces,
• Interaction between surface loading history and subgrade stress redistribution,
• Alteration of effective stress conditions in the vicinity of the well cellar.

These interpretations are presented as explanatory hypotheses only. Verification would require targeted geotechnical and hydrogeological investigation.

9.3 Not Asserted

This report does not assert:

• Membrane breach or confirmed containment failure,
• Casing compromise or well integrity failure,
• Deep structural deformation of the subsurface strata,
• Causation attributable to a specific subsurface mechanism,
• Imminent catastrophic risk.

The absence of such assertions is intentional. The purpose of this document is not to establish failure, but to document observable surface behaviour and spatially coherent elevation change prior to site disturbance.

10. Planning Implications and Requested Action

This section translates the observational and geospatial record into governance terms. The purpose is not to determine mechanism or assign liability, but to consider whether the documented conditions warrant structured review prior to irreversible site modification.

10.1 Summary of Observed Sensitivity

The preceding sections document:

• Spatial clustering of surface wetting and intervention at fixed perimeter locations,
• Temporal persistence of boundary-aligned hydraulic expression across multiple operational phases and rainfall events,
• Localised moisture expression and aggregate redistribution at the well cellar interface,
• Magnitude-defined elevation change in the LiDAR differencing product spatially coincident with observed surface expression zones,
• Repeated surface modification and drainage intervention at the same geometric coordinates.

These observations establish that the site exhibits spatially organised and temporally persistent hydro-mechanical behaviour concentrated along engineered interfaces.

The record does not establish failure. It does establish that the system is active and responsive under loading conditions.

10.2 Implications for Deconstruction Timeline

The current planning requirement anticipates removal of the engineered pad within a defined timeframe. Deconstruction will necessarily alter:

• Surface loading conditions,
• Drainage geometry and hydraulic routing,
• Subgrade stress distribution,
• The physical configuration of perimeter and cellar interfaces.

Where persistent hydro-mechanical expression has been documented, removal of the engineered structure without prior characterisation may:

• Obscure existing diagnostic features,
• Modify hydraulic gradients and stress conditions,
• Redistribute fines and aggregate masking pre-existing patterns,
• Alter the stress regime surrounding the well cellar and casing system prior to verification of current integrity conditions,
• Remove material potentially exposed to operational fluids without formal waste classification.

The question raised is not whether deconstruction should occur. The question is whether it should proceed without first documenting and verifying the present condition of the system.

10.3 Requested Action

In light of the documented observations, the following actions are requested prior to commencement of significant surface disturbance:

1. Formal logging of this evidential record within the planning file.

2. Independent pre-disturbance site characterisation addressing:

• Current surface geometry,
• Shallow groundwater head conditions,
• Subgrade consolidation state,
• Well cellar structural condition,
• Membrane and perimeter interface integrity.

Waste classification testing of aggregate, fines, and subgrade material within zones previously exhibiting operational fluid contact.

Documentation of findings prior to removal of engineered containment and drainage controls.

These actions are proportionate to the spatial and temporal coherence documented in this report. They do not presume failure. They ensure that decision-making occurs with full awareness of current site condition before irreversible modification takes place.

10.4 Waste Characterisation Prior to Removal

The observational record documents repeated surface pooling and staining of drilling-related fluids across the engineered pad surface during operational phases. Subsequent imagery shows placement of additional gravel and aggregate over areas previously exhibiting fluid accumulation and surface discolouration.

Where drilling fluids, returns, or associated operational materials have contacted the pad surface, the overlying aggregate and fines may have acted as a receptor medium. The addition of fresh gravel does not negate the need to determine the chemical classification of underlying material.

Prior to removal or off-site disposal of pad aggregate, subgrade material, or associated fines, appropriate waste classification testing should be undertaken in accordance with applicable environmental regulations. This ensures that material is characterised accurately and managed in a manner consistent with regulatory requirements.

The purpose of this request is not to assert contamination, but to ensure that materials potentially exposed to operational fluids are formally assessed prior to excavation and transport.

Version Statement

This document constitutes Version 1.0 of the evidential record submitted prior to commencement of significant surface deconstruction works.

The present submission focuses on observational documentation, spatial analysis, and procedural implications.

Supplementary material, including expanded technical appendices, figure tables, and referenced literature, may be compiled in subsequent versions if required.